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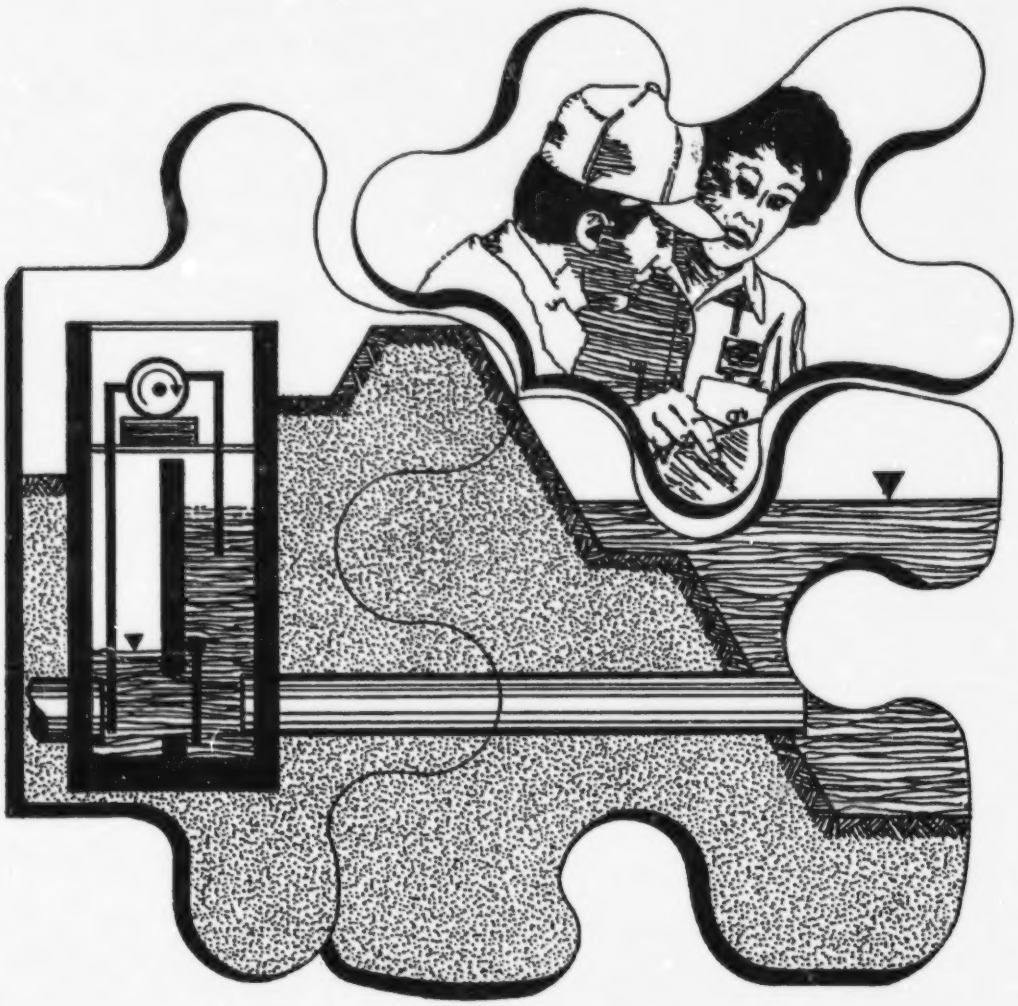
THE ANNUAL REPORT

OF THE

DYKING COMMISSIONER

•FOR THE YEAR ENDING DEC. 31,1997•



SUBMITTED TO:

The Hon. **J. Glen Cummings**

Minister

Department of Natural Resources

SUBMITTED BY:

F. BARLISHEN P. Eng.

Dyking Commissioner

Manitoba

Natural Resources

Water Resources Branch
1577 Dublin Avenue
Winnipeg, Manitoba
R3E 3J5
Tel: (204) 945-6496
Fax: (204) 945-7419

March 26, 1998

File: 11.1.5

The Honourable J. Glen Cummings
Minister
Department of Natural Resources
Room 333 Legislative Building
450 Broadway Avenue
WINNIPEG MB R3C 0V8

Dear Sir:

I have the privilege to submit, herewith, the Annual report of the Dyking Commissioner as required under Section 13 of The Dyking Authority Act.

This report covers the appraisal of the Greater Winnipeg Dyking System and ancillary Pumping Stations for the 1997 calendar year, to determine its adequacy to provide flood protection for the City of Winnipeg. This report also describes the additional effort that was required to combat "The Flood of the Century". The Commissioner considers the maintenance of the system to be satisfactory. Recommendations are included on page 6.

Please note that the Act does not require this report to be tabled in the Legislature.

Yours truly,

F.P. Barlishen, P.E.
Dyking Commissioner

FPB:jj

Enclosure

THE ANNUAL REPORT

OF THE

DYKING COMMISSIONER

FOR THE YEAR ENDING

DECEMBER 31, 1997

101-01502/

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1 Acknowledgements

Evaluation of the adequacy of the dyking system is based mainly on reports provided by the staff of the City of Winnipeg and the University of Manitoba. Their cooperation in providing annual reports and technical advice is gratefully acknowledged.

2 The Dyking Authority Act of 1952

The Dyking Authority Act D110, passed in 1952, was intended to ensure that the dykes and pumping stations constructed subsequent to the 1950 flood were maintained in a state of readiness to combat future floods. In fact, the full title of the original Act was *An Act to Provide for the Maintenance of Dykes and Pumping Stations in Greater Winnipeg.*

While authority and control over dykes and pumping stations was vested with the city or rural municipality in which they were situated, provision was made for the appointment of a Dyking Commissioner with powers to inspect dykes and pumping stations and to order work to be undertaken to maintain an integrated system of flood defence as well as to establish the location of the line of defence.

The Dyking Commissioner is required to "before the first day of April in each year, to make to the Minister a report on the administration and carrying out of the provisions of this Act during the year ending on the thirty-first day of December next preceding the making of the report, and on the condition of the dykes, pumping stations, and pumps, and their sufficiency for the purposes for which they were constructed or installed.

3 Changes Since 1952

Several major changes have taken place since the passing of The Act in 1952.

1. Major flood control projects affecting the City of Winnipeg namely the Red River Floodway, Portage Diversion and Shellmouth Dam projects have been completed.

2. Urban development has taken place beyond the lines of flood defence established earlier.

3. The five cities and two rural municipalities subject to The Act have been replaced by a single city.

4. Under the Canada-Manitoba Flood Damage Reduction Agreement Interim Flood Risk Maps designating Flood Risk Areas and Floodways in the City of Winnipeg were produced in 1980 and flood protection criteria for developments dictated by flood levels were defined.

5. The City of Winnipeg Act was amended in 1981 to recognize the designated flood risk areas and the criteria for development in flood prone areas.

6. As of January 1, 1992 the Designated Floodway Fringe Area Regulation 266/91 requires the Primary Dyke to be located, designed and constructed to the standard and elevation approved by the City Administrator and the Dyking Commissioner

4 Current Issues and Actions

Changes to legislation and the dynamics of urban development give rise to issues from time to time. Present issues are:

1. Flood defence lines are continually requiring revisions to accommodate the effect of the Red River Floodway and urban development.

   The City is continuing to review the Primary Dyke System for redesignation and extensions. Plans are being prepared and will be submitted to the Dyking Commissioner for approval. Some preliminary proposals have been reviewed with the Commissioner as noted in the City of Winnipeg report in Appendix C. The City is continuing to update the maps of the primary dykes on AutoCAD. Approximately 85 percent of the required upgrading of the maps has been completed. This project is to be completed in the next year due to the urgency to have this information as a result of the 1997 spring flood event. In addition to mapping the 115 kms of primary dykes, these drawings will also identify deficiencies in the primary dyking system, the required quantity of fill material to raise the dykes to the required protection levels and the location of the sewer manholes, catch basins, outfalls and control chambers through the dyke. Areas where the dyke must be aligned to accommodate new development will also be included.

2. A review of the Dyking Authority Act was indicated as being required to clarify its area of jurisdiction and the expansion of this jurisdiction to outside the City of Winnipeg such as the Red River Valley community dyking systems.

   The Dyking Authority Act was subjected to an internal departmental audit and reviewed by the Commissioner. The audit did not find any shortcomings in The Act nor in how the legislation has been acted on. Based on the past cooperation from the University of Manitoba, the City of Winnipeg, Manitoba Highways and Transportation and Manitoba Department of Natural Resources the need for amending The Act to include additional jurisdiction is not necessary at this time. However, if there is any change to the ownership or responsibility for the Red River Valley community dyking systems this would have to be reviewed.

3. Prior to the 1997 flood the last major flood fighting operation in the City occurred in 1966.

   On February 23, 1989 an Extreme Flood Workshop was held with good attendance from the City of Winnipeg departments, from Manitoba Natural Resources and from Emergency Measures Organization. This proved to be useful towards preparedness. There was some concern with regard to the City being able to fight an extreme flood. However, the 1997 flood event proved to be a test for all levels of government. City of Winnipeg staff, along with an army of volunteers, the Canadian Forces and the Geotechnical Emergency Response Team (GERT) were able to provide the extraordinary effort to combat the flood.

5 Inspection of Facilities

The City and the University have ongoing inspection and maintenance programs.

I have been impressed with the degree of care which the City and University apply to their flood protection facilities and I am certainly impressed with their reaction to the 1997 flood event.

6 Reports by the City of Winnipeg and the University of Manitoba

A questionnaire was sent to the City and to the University requesting information for the purpose of preparing this report. A copy of the request and questionnaire is included in Appendix B. The replies to the questionnaire, included in Appendix C, indicate that inspections were carried out, and that necessary maintenance work was carried out. The facilities appear to have survived the flood of 1997.

7 Primary Dyking System

The 1997 spring flood on the Red River in Manitoba was the highest recorded this century. Peak stages from the United States boundary to the Red River Floodway Control Structure just south of Winnipeg were 0.6 to 1.5 metres higher than for the great floods of 1950 and 1979. Levels in downtown Winnipeg were 1.5 metres higher than for any flood since 1969 when the Red River Floodway went into operation. Use of major flood control works reduced the peak stage in Winnipeg by 3.0 metres. Flood damages prevented by the operation of flood control works and emergency dyking are estimated at over $6 billion with the majority of these being with the City of Winnipeg.

At least 1840 square kilometres of valley lands were flooded as the Red River Rose 12 metres above winter levels. The City of Winnipeg sustained little damage due to flood control works and emergency dyking. However, one town, one hamlet and numerous farm properties in the valley were seriously flooded.

The main cause of the 1997 flood was an extreme snowpack which was at the 98th percentile level. Other factors included high topsoil moisture due to heavy fall rains in 1996, and unfavourable timing of runoff from major source areas in the basin. A major storm in early April, spawned in Colorado, added greatly to the flooding by dumping 50 to 90 mm of water in the form of rain (south) and snow (north). Airborne

gamma snow surveys indicated a record high water content of the snowpack The Red River reached a peak of 24.5 feet above city datum at James Avenue on May 3, 1997. The river receded to below normal summer level by June 17th, 1997 and flood control operations were discontinued. A second rise in river levels began on June 30th, 1997 as a result of heavy rainfall in the southern portions of the Red River Basin. The second rise peaked at 12.9 feet above James Avenue on July 8th, 1997 and receded to normal summer level by July 30th, 1997.

1. Pumping Stations and Gates

All flood pumping stations were winterized during October and November and were checked on a weekly basis. With the automation of three more flood pumping stations in 1997, a total of twenty-eight (28) of the City's thirty-six (36) flood pumping stations are now automated. The stations are automated to activate at James Avenue datum elevation 19.0, with one other automated station to be activated 20 feet James Avenue. Upgrading of the City's flood and lift station alarm and monitoring system also took place in 1997, resulting in improved data availability and offering the potential for enhanced operations. The City is continuing with a program to evaluate and upgrade the configuration of the flap and positive gates at the automated stations. During the flood the first pumping station was activated on March 21, 1997 and the last pumping station deactivated was on July 28, 1997. During the height of the flood all the City's pumping stations were operated along with 131 flap and positive gates. Over 300 pumps were also used on a temporary basis.

2. Primary Line of Defence

The primary dyking system for most of its length is equivalent to 27.8 feet at James Avenue. However there are still stretches of the 115 km of primary dyke line that are not up to this level of protection. With the forecast of 24.5 feet at James Avenue Pumping Station the primary dyke would have to built to 26.5 feet at James Avenue to include two feet of freeboard. Some 26 locations or culverts that were identified as breaches through the primary dyke were plugged along with some 25 locations where the primary dyke was raised. Many secondary dykes were constructed to protect homes on the river side of the primary dyking system.

Although there were homes that were flooded in Winnipeg, these were as a result of individual dyking systems proving not to be adequate.

The University of Manitoba and the City of Winnipeg do maintain and update their respective flood control manuals.

8 Additional Works Constructed

No major works or repairs were undertaken in 1997. However, as a result of the high water levels during the flood event there were a number of difficulties encountered with regard to a number of outfalls. A number of gates have been repaired and are scheduled to be repaired and a number of outfalls have been identified as requiring flap and positive gates.

9 Recommendations

It is recommended that:

1. City of Winnipeg complete the mapping of the revisions and extensions of the lines of defence.

2. The City of Winnipeg undertake all the necessary repairs and upgrading to the primary dyking system, pump gates and outfalls through the primary dyke line, to ensure, maintain and enhance the integrity of the system.

3. With the experience gained from the 1997 flood event, all flood fighting plans be reviewed and adjusted to ensure that in the event of a similar flood these plans are current.

10 Appendix A

City of Winnipeg
List of Flood Pumping Stations and Gate Chambers

CITY OF WINNIPEG FLOOD CONTROL FACILITIES - 1997

FLOOD PUMPING STATIONS:

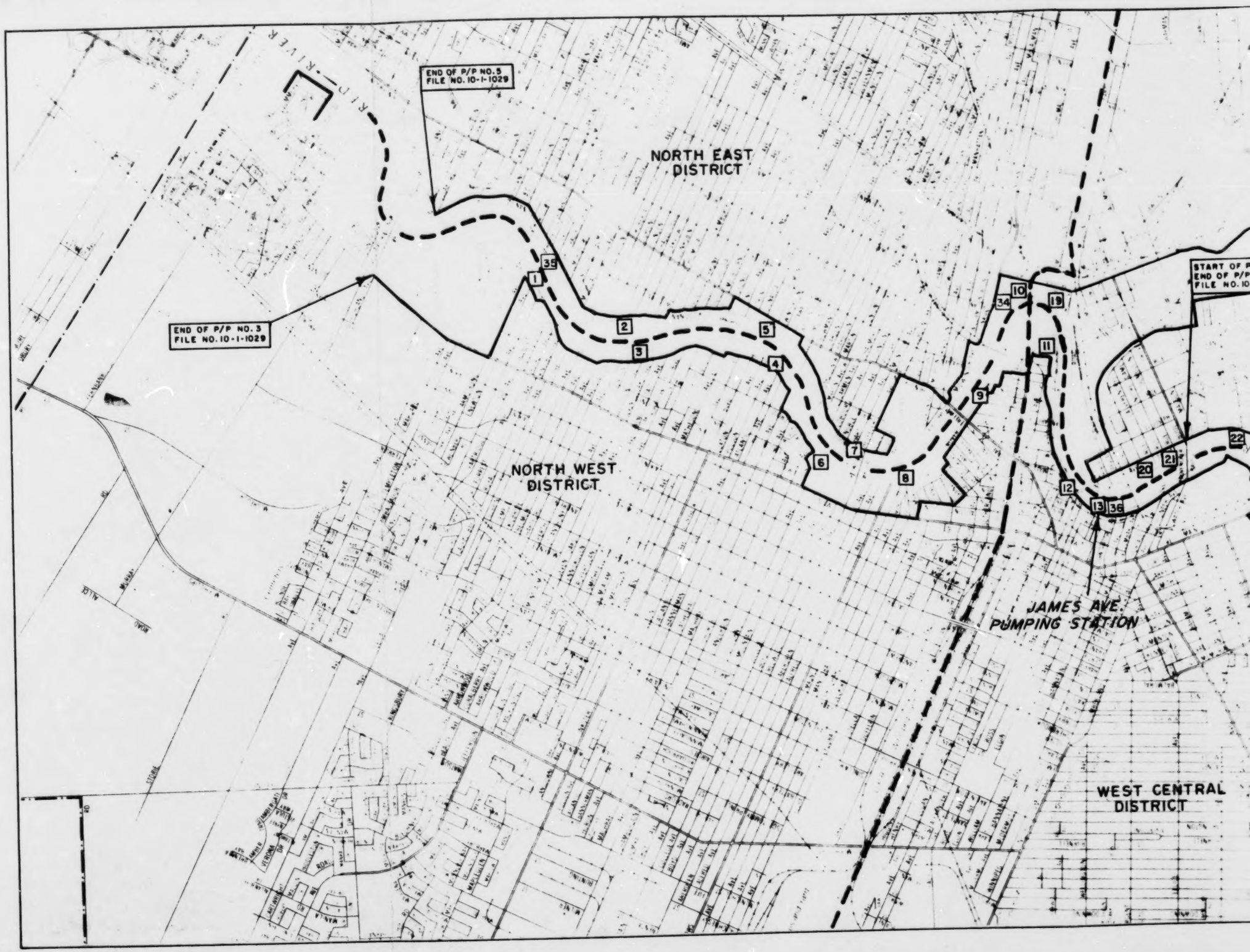
1 Newton
2 Linden
3 Jefferson
4 Polson
5 Monroe
6 St. John
7 Hart
8 Selkirk
9 Syndicate
10 Archibald Underpass
11 Boyle
12 Galt
13 James Avenue
14 Assiniboine
15 Colony
16 Cornish
17 Aubrey
18 Clifton
19 Mission
20 Laverendrye
21 Dumoulin
22 Despins
23 River
24 Ash
25 Marion
26 Jessie
27 Metcalfe
28 Baltimore
29 Mager Drive
30 Cockburn
31 Ferry Road
32 Turnbull Drive
33 St. James Underpass
34 Roland (not in index)
35 Larchdale
36 Bannatyne

GATE CHAMBERS:

Rainbow Stage
St. Mary's Road
Armstrong
Ft. Rouge Park
Maryland
Renfrew
St. Norbert X-Kalay
Eccles (new 1200mm SRS)
Wildwood Golf Course
X-Kalay Drive Culvert
Darcy @ Glengarry
Crane @ Southdrive (WWS)
Kilkenny N. of Radcliffe
N.E. Interceptor
Ruby
Pembina & Crane
Aubrey (Storm)
Kingston Row CSO
Trappiste @ Pembina
Assiniboine E.
Assiniboine W.
Burrows
Calrossie @ Riverside
Ducharme @ Villineuve
Eccles (old 750mm SRS)
Kilkenny & Rice
Lombard
McDermot
Spence
Somerset @ Riverside
Bredin Drive
Canora
Guay
Churchill Drive Underpass
Churchill High School
Bredin Drive
Chataway
Deer Lodge Place
Douglas Park
Ferry Road
Kildonan Park
Lemay & Lord
Olive Street
Conway
Cranestorm
Donald Street
Dowker Outfall
Osborne @ St. Vital Bridge G.C.
Hargrave Street
Inkster
Kennedy
Kingston Row Underpass
Riviera Crescent Outfall
Water Avenue
Clarence & Hamlin
Colony
Dieppe
Hawthorne
Parkside 30"
Parkville
Sommerville & Beaumont
St. Boniface Hospital MH
Kildare
Riverdale
McLeod Cr. & Kildonan Cor.
Donacaster
Dunham Road
Plaza Drive
Pulberry
Seel & Fennel
Darcy 43 m N. of Glengarry
Glasgow
Summerview Lane
South St. Vital Ret. Basin
N. St. Boniface LDS
Shier Drive
Barker
Waverley Lakes
Arlington
Calrossie Outfall
Conway
Moore
Strathmillan
Wexford
Killarney
Rowandale
Ridgedale
River Point Pl.
Clifton Overflow (Omands Cr.)
Forks
Heritage
N.E. Interceptor Manhole
King Edward Storm
Kingston Row @ Elm Park
Riverbend 90"
Tylehurst
Lot 16 Gate
Fermor

11 Appendix B

City of Winnipeg Maps - Showing District Boundaries,
Flood Defence Lines and Pumping Station Locations


RIVER
END OF P/P NO. 5
FILE NO. 10-1-1029
END OF P/P NO. 3
FILE NO. 10-1-1029
NORTH EAST
DISTRICT
NORTH WEST
DISTRICT
WEST CENTRAL
DISTRICT
JAMES AVE.
PUMPING STATION
35
1
2
3
4
5
6
7
8
9
10
34
11
12
13
36
19
20
21
22

SOUTH EAST DISTRICT

START OF P/P NO. 3
FILE NO. 10-1-1029

START OF P/P NO. 2
END OF P/P NO. 2
FILE NO. 10-1-1029

START OF P/P NO. 1
END OF P/P NO. 1
START OF P/P NO. 4
FILE NO. 10-1-1029

JAMES AVE. PUMPING STATION

WEST CENTRAL DISTRICT

SOUTH WEST DISTRICT

RED RIVER

7 8 9 10 11 12 13 19 20 21 22 23 25 26 27 28 29 30 34 36

RED RIVER
Kings Park
Maple Grove Park
RED RIVER FLOODWAY
ST MARYS
CONCHARAN BRIDGE
DAVIS RD
PIERRE
RIVER
32
END OF P/P NO. 6
FILE NO. 10-1-1029
END OF P/P NO. 6
FILE NO. 10-1-1029
WATER RESOURCES BRANCH
CITY OF WINNIPEG
DISTRICT BOUNDARIES
FLOOD DEFENCE LINES
PUMPING STATION LOCATIONS
FILE NO. 10-1-1039D SH. 1 of 2

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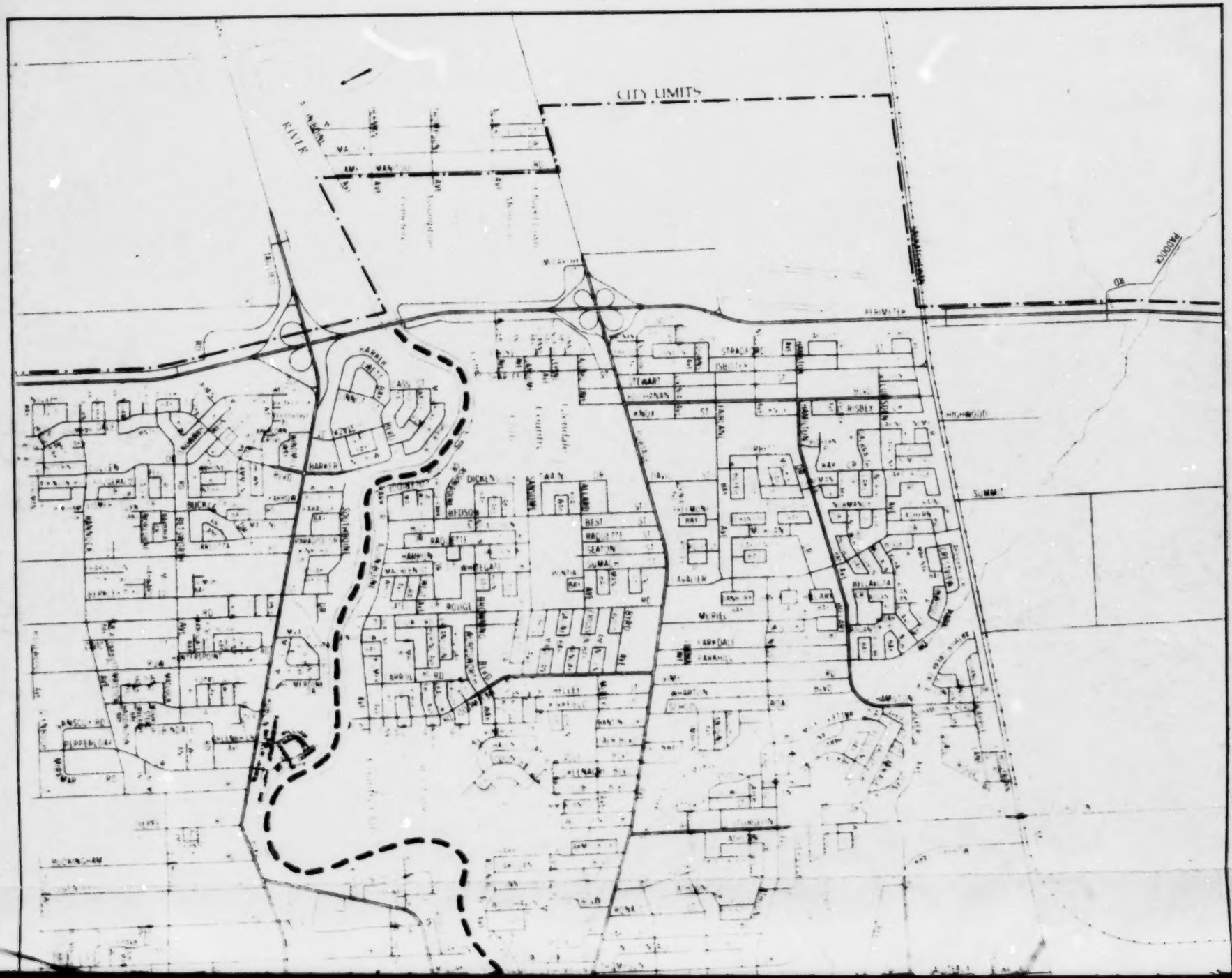
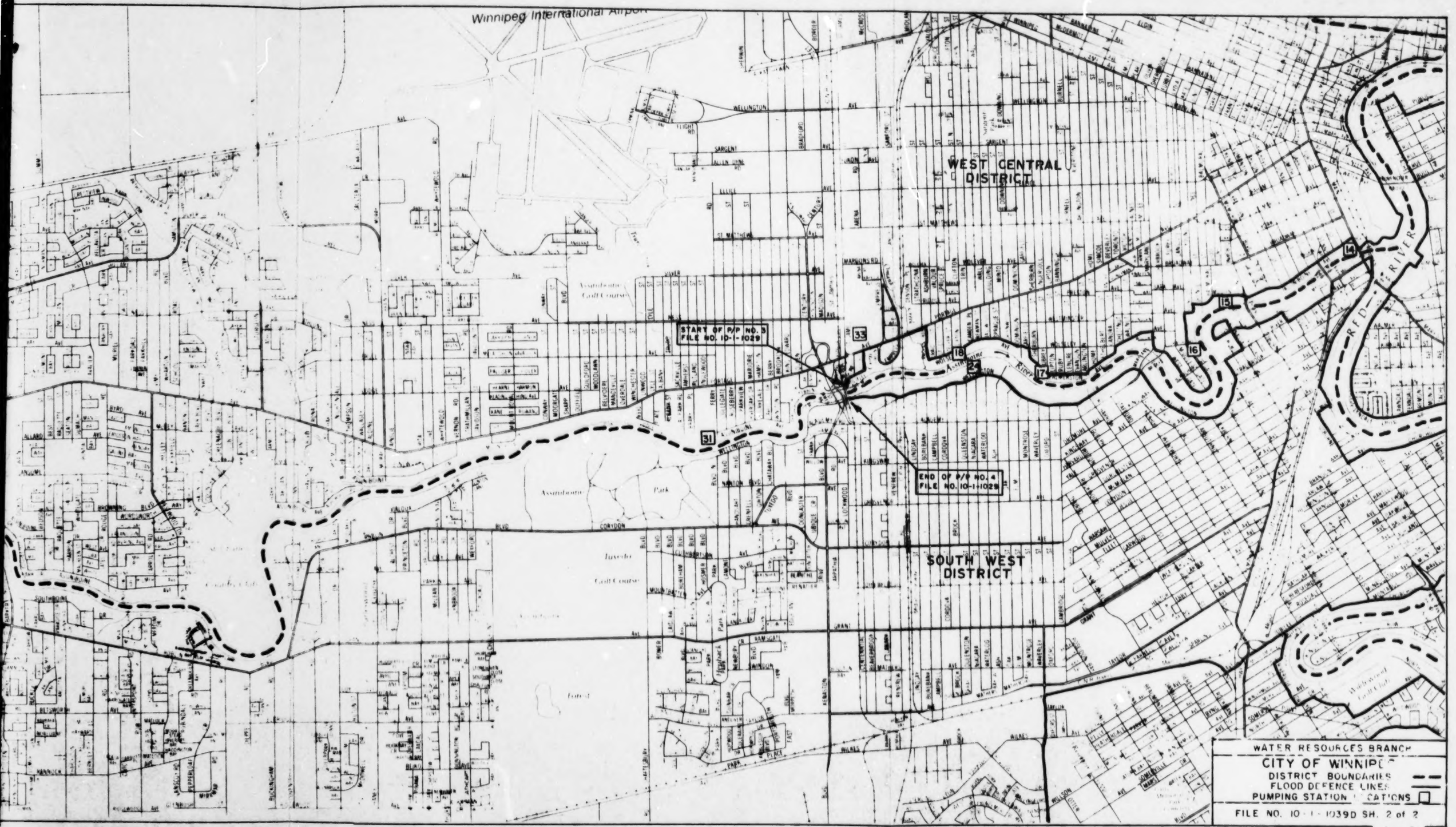

CITY LIMITS


Winnipeg International Airport
WEST CENTRAL DISTRICT
SOUTH WEST DISTRICT
START OF P/P NO. 3
FILE NO. 10-1-1029
END OF P/P NO. 4
FILE NO. 10-1-1029
RED RIVER
Assiniboine River
Assiniboine Park
Assiniboine Golf Course
Tuxedo Golf Course
WELLINGTON
SARGENT
ALLEN UNIL RD
WARNING RD
CORYDON BLVD
GRANT
WATER PLANT
31
33
18
17
16
15
14
WATER RESOURCES BRANCH
CITY OF WINNIPEG
DISTRICT BOUNDARIES
FLOOD DEFENCE LINES
PUMPING STATION LOCATIONS
FILE NO. 10-1-1039D SH. 2 of 2
15 02 95

12 Appendix C

Copy of Questionnaire to:

The City of Winnipeg
and
The University of Manitoba

Water Resources Branch
1577 Dublin Avenue
Winnipeg, Manitoba
R3E 3J5
Tel: (204) 945-6496
Fax: (204) 945-7419

December 8, 1997

File: 11.1.5

Mr. Barry McBride
Director
Water and Waste Department
The City of Winnipeg
101 - 1155 Pacific Avenue
WINNIPEG MB R3E 3P1

Dear Mr. McBride:

RE: Dyking Commissioner's 1997Annual Report

The Dyking Authority Act, Section 15, requires that:

> "The commissioner shall, before the first day of April in each year, make to the minister a report on the administration and carrying out of the provisions of this Act during the year ending on the thirty-first day of December next preceding the making of the report, and on the condition of the dykes, pumping stations, and pumps, and their sufficiency for the purposes for which they were constructed or installed."

To assist me in making this report I request that you supply me with a report on the dyking system and pumping stations under your jurisdiction **by February 27, 1998**. For convenience, I am including a standard questionnaire similar to that used in previous years.

As you are aware the flood event that we experienced this spring is referred to as the "Flood of the Century". I would appreciate the inclusion of a write up on the efforts undertaken by the City to ensure that the integrity of the Primary Dyking System was maintained during the flood.

Yours truly,

Frank P. Barlishen, P. Eng.
Dyking Commissioner

FPB/jj

cc: Steven D. Topping, Director
Water Resources Branch

Enclosure

QUESTIONNAIRE FOR THE ANNUAL REPORT ON THE PRIMARY DYKING SYSTEM WITHIN THE CITY OF WINNIPEG

1. For the Reporting Year

Please provide information concerning:

a) Difficulties and problems encountered.

b) Maintenance and repairs carried out.

c) New Sewer Outfall Gate Structures constructed.

d) Improvements and modifications carried out.

2. Proposed Plans for Future

Please provide information concerning proposed new structures, modifications to existing structures, and proposed improvements or additions to the dyking system. Also note any evaluation studies completed or underway in connection with the "Primary Dyking System".

Further, in view of the apparent river bank stability problems, please provide information in regard to:

a) Evaluation of river bank stability in critical areas.

b) Monitoring erosion of river banks in critical areas.

c) Any remedial works undertaken or completed in the reporting year.

3. Availability and Location of Proposed Borrow Pits

Indicate changes if any in availability and location of proposed borrow pits in the reporting year.

Water Resources Branch
1577 Dublin Avenue
Winnipeg, Manitoba
R3E 3J5
Tel: (204) 945-6496
Fax: (204) 945-7419

December 8, 1997

File: 11.1.5

Mrs. Debbie McCallum
Associate Vice-President
University of Manitoba
WINNIPEG MB R3T 2N2

Dear Mrs. McCallum:

RE: Dyking Commissioner's 1997 Annual Report

The Dyking Authority Act, Section 15, requires that:

> "The commissioner shall, before the first day of April in each year, make to the minister a report on the administration and carrying out of the provisions of this Act during the year ending on the thirty-first day of December next preceding the making of the report, and on the condition of the dykes, pumping stations, and pumps, and their sufficiency for the purposes for which they were constructed or installed."

To assist me in making this report I request that you supply me with a report on the dyking system and pumping stations under your jurisdiction for the 1997 calendar year **by February 27, 1997**. For convenience, I am including a standard questionnaire similar to that used in previous years. As you are aware, the flood that we experience this spring has been referred to as the "Flood of the Century". I would therefore appreciate any additional information regarding the effort that the University undertook in regard to maintaining the integrity of the dyking system during this event.

Yours truly,

Frank P. Barlishen, P. Eng.
Dyking Commissioner

FPB/jj

cc: Steven Topping, Director
Water Resources Branch

Enclosure

QUESTIONNAIRE FOR THE ANNUAL REPORT ON THE PRIMARY DYKING SYSTEM WITHIN THE CITY OF WINNIPEG

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Please provide information concerning:

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a) Evaluation of river bank stability in critical areas.

b) Monitoring erosion of river banks in critical areas.

c) Any remedial works undertaken or completed in the reporting year.

3. Availability and Location of Proposed Borrow Pits

Indicate changes if any in availability and location of proposed borrow pits in the reporting year.

13 Appendix D

Replies to the Questionnaire in Appendix B

from
The City of Winnipeg
and
The University of Manitoba

THE CITY OF WINNIPEG - VILLE DE WINNIPEG

WATER AND WASTE DEPARTMENT
SERVICE DES EAUX ET DES DÉCHETS

1500 PLESSIS ROAD
1500 CHEMIN PLESSIS
WINNIPEG, MANITOBA
R2C 5G6

FAX/TÉLÉC.: (204) 224-0032

February 27, 1998

Manitoba Department of Natural Resources
1577 Dublin Avenue
Winnipeg, MB
R3E 3J5

Attention: Mr. F.P. Barlishen, P.Eng. - Diking Commissioner

Dear Sir:

RE: DIKING COMMISSIONER'S 1997 ANNUAL REPORT
Our File No. 020-14-02-00-00

In reply to your letter of December 8, 1998 please find attached the 1997 Flood Activity Report of the Water and Waste Department and the Streets and Transportation Department with regard to Flood Pumping Stations and the Diking System within the City of Winnipeg.

Yours truly,

M.A. Shkolny, P.Eng.
Acting Manager of Engineering

/aed

Attach.
G:\CA\EDIWPDOC-REPS7\BARLISH.WPD

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1997 Flood Activity Report for The City of Winnipeg

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1.0 THE CITY OF WINNIPEG FLOOD CONTROL REPORT

The City of Winnipeg, Water and Waste Department is responsible for the Primary Line of Defence (primary dyking system) and the flood pumping stations within the City of Winnipeg. The following report summarizes the operations of these facilities for the 1997 calendar year.

Throughout the year, all flood pumping stations were inspected once per week by the Collection Systems crews of the Water and Waste Department. All stations were checked for temperature, basement flooding and vandalism. All problems were repaired as soon as possible.

Commencing in the month of March, all stations were given a complete maintenance check to ensure that these facilities were ready for operation when required. This annual servicing includes:

i) lubricating and operating all positive gates on sanitary, storm and combined sewers;

ii) inspection of all wet well floats;

iii) lubricating and operating of all pumps and equipment within the station;

iv) inspection of all electrical main boxes, starter boxes and motors;

v) inspection of all high voltage transformers and equipment;

vi) inspection of automated control system, where installed.

The Red River reached a peak of 24.5 feet above City datum at James Avenue on May 3, 1997. The river receded to below normal summer level by June 17th, 1997 and flood control operations were discontinued. A second rise in river levels began on June 30th, 1997 as a result of heavy rainfall in the southern portions of the Red River Basin. This second rise peaked at 12.9 feet above James Avenue on July 8th, 1997 and receded to normal summer level by July 30th, 1997. The graph on page 3 illustrates the 1997 high river levels event, by plotting daily river levels and flows during this spring and summer's high river level period. The table on pages 4 through 8 summarizes the flood activities for 1997. River elevations shown on these tables are imperial and are recorded in James Avenue stages.

During the months of October and November, all flood pumping stations were winterized in conjunction with the routine weekly checks. With the automation of three more flood pumping stations in 1997, a total of twenty-eight (28) of the City's thirty-four flood pumping stations are now automated. All stations are now automated to activation at James Avenue datum elevation 19.0, with one other automated station at 20 feet James. Upgrading of the City's flood and lift station alarm and monitoring system also took place in 1997, resulting in improved data availability and offering the potential for enhanced operations. The Water and Waste Department is continuing with a program to evaluate and upgrade the configuration of the flap and positive gates at the automated stations.

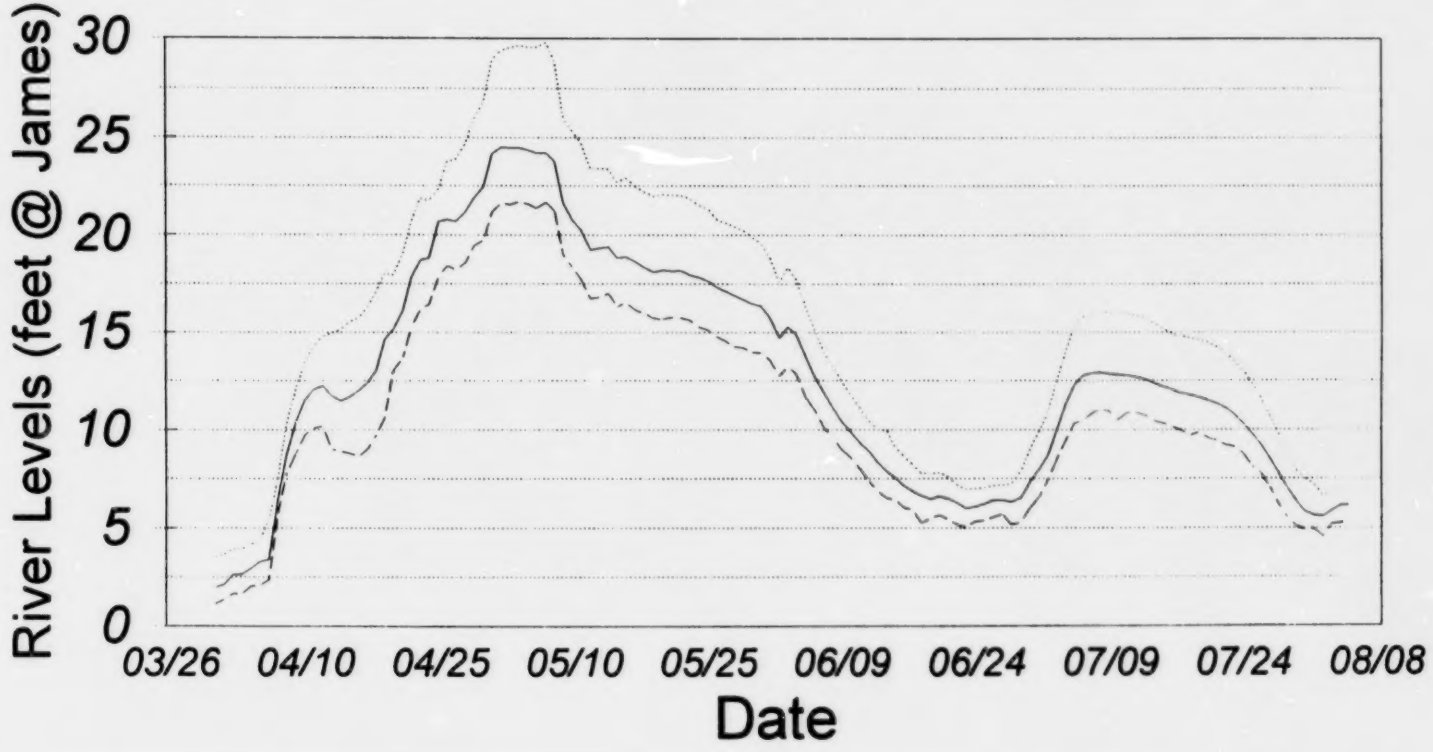
During 1997, river levels were recorded at James Avenue, and Bishop Grandin (Route 165) and Chief Peguis bridges. Generally, levels are forecast and flood operations proceed on the basis of James Avenue river levels. River level monitoring on the Assiniboine River was also investigated in 1995, and implementation is expected in 1998.

Close monitoring of Stormwater Retention Basin levels in 1997 enabled optimum use of conveyance and storage capacities within the existing land drainage infrastructure during peak river levels and runoff periods.

The Water and Waste Department has continued in its efforts to upgrade the information provided in the Flood Control Manual.

1997 FLOOD LEVELS

March 31 -August 5



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FLOOD PUMPING STATION	GATE CHAMBER	ACTIVATION/GATE CLOSED			DEACTIVATION/GATE OPENED		
		DATE	TIME	RIVER ELEV	DATE	TIME	RIVER ELEV
	St. Mary's Rd.	97 04 08 97 07 04	10:30 14:40	9.4 11.8	97 06 13 97 07 29	14:00 13:20	8.2 6.7
	Rainbow Stage	97 04 08	11:00	9.6	97 05 18	14:30	6.8
	Armstrong	97 04 07 97 07 02	14:50 14:15	7.9 8.8	97 05 09 97 07 28	11:00 14:00	24.2 7.5
Fort Rouge Park		97 04 07 97 07 02	14:25 09:00	7.9 9.2	97 06 12 97 07 28	14:45 10:30	8.9 7.2
	Maryland	97 04 07	15:00	8.0	N/A	N/A	N/A
Despins		97 04 07 97 07 02	14:00 08:30	7.9 7.6	97 06 11 97 07 28	09:30 08:50	9.2 7.6
	St. Norbert X-Kalay	97 04 08 97 07 02	09:40 10:30	9.4 9.0	97 06 11 97 07 28	09:15 09:30	9.2 7.6
	Wildwood Golf Course	97 04 14	14:30	11.5	97 06 11	N/A	9.2
	X-Kalay Drive Culvert	97 04 17	10:30	12.5	97 05 27	N/A	17.0
	N.E. Interceptor	97 04 07	15:10	8.0	N/A	N/A	N/A
	Aubrey (storm)	97 04 09 97 07 04	10:00 15:30	11.2 11.9	97 06 09 97 07 17	14:15 17:00	10.1 11.8
	Kingston Row CSO	97 04 10	08:30	11.7	N/A	N/A	N/A
	Ruby	97 04 09 97 07 04	10:50 17:00	11.2 11.9	97 06 09 97 07 17	15:00 09:30	10.1 11.8
	Trappistes @ Pembina	97 04 21	08:30	16.4	97 06 01	N/A	15.0
Baltimore		97 04 07 97 07 03	14:55 09:10	8.0 10.3	97 06 10 97 07 28	11:15 08:45	9.7 7.6
Marion		97 04 07 97 06 30	13:15 13:15	7.8 7.7	97 06 16 97 07 28	09:40 13:10	7.2 7.4
LaVerendrye		97 04 08 97 07 03	09:45 14:05	9.4 10.7	97 06 09 97 07 24	14:00 08:25	10.4 10.2
Parchdale		97 03 21	N/A	N/A	N/A	N/A	N/A

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		DATE	TIME	RIVER ELEV	DATE	TIME	RIVER ELEV
Jefferson		97 04 09 97 07 07	10:00 09:30	11.0 12.9	97 06 06 97 07 14	10:00 13:00	12.5 12.3
Linden		97 04 09 97 07 07	13:20 10:00	11.2 12.9	97 06 06 97 07 14	09:05 13:20	12.4 12.3
Mager Dr.		97 04 09 97 07 04	14:30 15:00	11.3 11.9	97 05 21 97 07 14	11:30 14:10	18.2 12.3
	Crane @ South Drive (WWS)	97 04 11	N/A	12.3	N/A	N/A	N/A
	Kilkenny N. of Radcliffe	97 04 28	15:00	21.5	97 05 12	11:00	19.0
Metcalfe		97 04 09 97 07 07	14:30 10:40	11.2 12.9	97 06 06 97 07 14	13:55 14:00	12.4 12.3
	Burrows	97 04 11	09:00	12.2	97 06 05	09:30	13.5
	Lombard	97 04 11	09:30	12.2	97 06 05	09:50	13.5
	McDermot	97 04 11	10:15	12.2	97 06 05	11:00	13.5
	Spence	97 04 10	11:00	11.8	97 06 09	13:15	10.1
	Somerset at Riverside	N/A	N/A	N/A	97 05 10	16:30	20.4
	Pembina & Minerva	97 04 11	13:45	12.2	97 06 06	14:20	12.2
Cockburn		97 04 11	11:15	12.2	97 06 06	14:00	12.2
	Ducharme @ Villeneuve	97 04 21	15:00	16.4	97 04 28	N/A	16.7
	Eccles (750 mm)	97 04 11	10:45	12.2	97 06 05	11:10	13.5
	Kilkenny & Rice	97 04 26	17:00	20.6	97 05 16	13:30	18.8
	Kilkenny and Kings Drive Outfall	97 04 28	N/A	21.5	97 05 10	N/A	20.4
	Somerset at Riverside	97 04 30	N/A	23.1	97 05 10	N/A	20.4
Newton		97 04 11	09:00	12.2	97 06 09	09:00	10.3
Turnbull Drive		97 04 02	16:00	2.5	97 10 15	10:30	7.4

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		DATE	TIME	RIVER ELEV	DATE	TIME	RIVER ELEV
rchibald nderpass		97 04 11	14:30	12.2	97 06 04	09:00	14.4
annatyne		97 04 11	13:00	12.2	97 06 04	10:00	14.4
	Bredin Drive (set up pump)	97 04 11	09:45	12.2	97 06 03	09:00	15.0
	Canora	97 04 10 N/A	09:15 N/A	11.8 N/A	97 06 04 97 06 09	09:30 13:00	14.4 10.1
art		97 04 11	14:00	12.2	97 06 01	17:20	15.0
yndicate		97 04 11	10:30	12.2	97 06 04	10:15	14.4
umoulin		97 04 19	13:50	15.5	97 06 02	09:30	14.4
alt		97 04 19	09:00	15.1	97 06 02	09:00	14.4
olson		97 04 19	14:30	15.5	97 06 06	13:00	12.5
ssiniboine		97 04 21	10:45	16.6	97 05 26	10:40	17.2
olony		97 04 21	11:00	16.6	97 05 26	10:45	17.2
unroe		97 04 21	14:10	16.9	97 05 22	13:50	18.0
ayfair		97 04 21	11:30	16.6	97 05 26	10:30	17.2
oland		97 04 21	09:45	16.6	97 05 26	09:00	17.2
ebrey		97 04 22	15:00	18.8	97 05 20	11:15	18.1
h		97 04 21	14:00	16.8	97 06 02	13:00	14.4
ssie		97 04 19	13:15	16.6	97 06 02	09:30	14.4
ssion		97 04 19	13:50	15.5	97 05 20	09:00	18.1
James derpass		97 04 21	13:30	16.8	97 05 20	11:00	18.1
	Churchill Drive Underpass	97 04 22	09:00	18.1	97 05 26	N/A	17.1
	Chataway	97 04 20	09:00	15.2	97 05 26	14:00	17.1
	Deer Lodge Place	97 04 19	15:40	15.7	97 06 01	19:05	14.9
	Douglas Park	97 04 19	15:50	15.7	97 06 01	19:10	14.9
	Ferry Road	97 04 19	16:00	15.7	N/A	N/A	N/A

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FLOOD PUMPING STATION	GATE CHAMBER	ACTIVATION/GATE CLOSED			DEACTIVATION/GATE OPENED		
		DATE	TIME	RIVER ELEV	DATE	TIME	RIVER ELEV
	Lemay & Lord	97 04 28	02:00	21.3	97 05 30	N/A	16.3
	Olive St.	97 04 19	15:20	15.7	N/A	N/A	N/A
	Conway	97 04 19	15:30	15.7	N/A	N/A	N/A
	Donald Street	97 04 19	16:50	15.6	97 05 30	13:20	16.4
	Dowker Outfall	97 04 30	15:00	23.7	97 05 06	15:00	24.2
	Hargrave Street	97 04 19	16:20	15.7	N/A	N/A	N/A
	Inkster	97 04 19	14:45	15.5	N/A	N/A	N/A
	Kennedy	97 04 19	16:15	15.7	N/A	N/A	N/A
	Kingston Row Underpass	97 04 21	06:30	17.4	97 05 25	18:00	17.4
	Riviera Crescent Outfall	97 04 30	13:00	23.7	97 05 07	18:00	24.2
	Water Avenue	97 04 19	13:15	15.5	97 05 30	14:00	16.4
	Clarence & Hamlin	97 04 21	10:30	16.6	N/A	N/A	N/A
	Dieppe	97 04 21	10:00	16.6	N/A	N/A	N/A
	Hawthorne	97 04 21	13:45	16.9	97 05 22	14:30	18.0
	Parkside (30")	97 04 21	10:30	16.6	97 05 07	16:30	24.1
	Parkville	97 04 24	23:00	20.0	97 05 12	10:00	19.0
	Woodvale and Greene	97 04 23	14:00	18.6	97 05 29	13:00	16.6
	Kildare	97 04 22	N/A	18.5	N/A	N/A	N/A
	Riverdale G.C.	97 04 28	19:30	21.6	97 05 12	09:30	19.1
	McLeod Cr. & Kildonan Corr.	97 04 21	19:30	17.7	97 05 12	09:00	19.1
	Dunham LDS	97 04 27	N/A	20.7	97 05 29	N/A	16.5
	Plaza Drive	97 04 24	N/A	19.7	97 05 13	N/A	19.5
Cornish		97 04 24	22:00	19.9	97 05 12	15:00	19.0
Selkirk		97 04 24	16:45	19.9	97 05 12	13:50	19.0

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FLOOD PUMPING STATION	GATE CHAMBER	ACTIVATION/GATE CLOSED			DEACTIVATION/GATE OPENED		
		DATE	TIME	RIVER ELEV	DATE	TIME	RIVER ELEV
St. John's		97 04 24	17:40	19.9	97 05 12	14:10	19.0
	Glasgow	97 04 21	20:30	17.7	97 05 12	08:55	19.1
	Summerview Lane	97 04 24	10:00	19.1	97 05 10	10:00	20.0
	South St. Vital SRB	97 05 03	14:30	24.5	97 05 09	13:30	20.9
	Barker	97 04 25	19:00	21.0	97 05 12	10:00	19.1
Clifton		97 04 28	22:30	21.8	97 05 10	07:00	20.6
	Arlington	97 04 28	16:40	21.6	97 05 09	22:45	20.2
	Calrossie Outfall	97 04 28	11:00	21.2	97 05 29	N/A	16.6
	Conway	97 04 28	23:11	21.8	N/A	N/A	N/A
	Moore	97 04 28	22:00	21.6	97 05 09	17:10	20.8
	Strathmillian	97 04 28	23:00	21.8	N/A	N/A	N/A
	Rowandale	N/A	N/A	N/A	97 05 09	13:00	21.1
	Ridgedale	97 04 28	19:30	21.6	N/A	N/A	N/A
	River Point Place	97 04 25	10:00	21.0	97 05 09	10:30	21.2
	Clifton Overflow (Omands Creek)	97 04 30	16:15	23.3	97 05 07	17:45	24.2
	King Edward Storm	97 04 30	15:50	23.8	97 05 07	17:30	24.2
	Kingston Row @ Elm Park	97 04 30	17:00	24.0	97 05 09	11:00	21.0
	Riverbend 90"	97 04 30	14:30	23.8	97 05 07	14:45	24.2
	Tylehurst	97 04 30	16:00	23.3	97 05 07	17:00	24.2
	Lot 16 Gate	N/A	N/A	N/A	97 05 13	12:15	19..5
	Fermor G.C.	97 05 04	06:45	24.4	97 05 06	23:00	24.3

2.0 EXTENSIONS AND REDESIGNATIONS OF THE PRIMARY LINE OF FLOOD DEFENCE

2.1 East Area

2.1.1 Kildonan Drive Dike - Investigations providing for extension of the Primary Line of Defence north of the Bergen cut-off are on-going, in association with Development applications on the cut-off. On February 13, 1991, the City was granted a dike easement through the lands zoned Park on the Edgewood Estates' property, north of the Bergen cut-off and at the north end of Kildonan Drive. On February 17, 1992, the Dyking Commissioner granted approval-in-principle for the designation of lands through Edgewood Estates' property as Primary Line of Flood Defence. Finalization of the easement agreement is pending upon review by the property owner.

During the 1997 Spring Flood event, a permanent earth dike was constructed through the Edgewood Estates' property extending from the Kildonan Drive right-of-way at the South to the existing embankment of the Chief Peguis Trail to the North. The Water and Waste Department will be proceeding with application for designation of the dike once drawings described in Section 4.0 are complete for this area and the easement agreement is secured.

2.1.2 Canoe Club Condominium Complex - Construction of the proposed condominium necessitated relocation of the Primary Line of Defence (PLD). On January 28, 1992, the Dyking Commissioner granted approval-in-principle for the relocation of the PLD. On September 22, 1992, a Supplemental Lease Agreement was executed for the proposed PLD relocation and the existing PLD. Once the Consultant provides an as-constructed drawing, the Water and Waste Department will be proceeding with application for redesignation.

2.1.3 Evans Street Dike - Land acquisition of private lands along the west Seine River bank is essentially complete. Land acquisition negotiations are on-going for private lands along the east Seine River bank. Once secured, the lands will accommodate relocation of the Seine River at a bend, and stabilization and reconstruction of Evans Street from Gareau Street to Deniset Street for its proposed designation as a Primary Line of Defence. Some 200 dwellings and several sewer overflows will be added to the City's flood protection system through this initiative.

2.1.4 Normand Park Development Dike - The most recent extension of the primary dike along the north limit of the Normand Park Development was completed in December, 1989; however deficiencies were only rectified in November, 1992. Certificates were issued for the dikes in the last two of the five developments. The Water and Waste Department will be proceeding with application for designation of the dike once drawings described in Section 4.0 are complete for this area and for the area described in Section 2.1.5.

2.1.5 St. Anne's Road Dike - The Water and Waste Department will be proceeding with application for designation of the dike once drawings described in Section 4.0 are complete for this area

2.1.6 St. Mary's Road Dike - The Water and Waste Department will be proceeding with application for designation of the dike once drawings described in Section 4.0 are complete for this area.

2.2 North Area

2.2.1 The Forks Development Dike - A leakage test on the chamber was performed and passed on February 21, 1992. Deficiencies regarding modifications to the top of the structure are still outstanding. The Water and Waste Department will be proceeding with application for redesignation of the dike once final acceptance of the gate chamber is issued.

On June 18, 1993, the Water and Waste Department requested approval-in-principle of a dike realignment as a result of a proposed plaza/archaeological dig site at the Forks. On July 21, 1993, the Dyking Commissioner granted approval-in-principle for this relocation. The project proceeded as a plaza in 1997 without the archaeological dig site. Therefore, the primary dike alignment was not relocated. Redesignation with this portion of the dike will be part of the whole Forks Development, as above.

2.2.2 Timber Crib Dike - There is a proposal to construct a new Baseball Facility at the North side of Water Avenue, adjacent to the existing timber crib dike. Preliminary discussions with the project planners have indicated that the project will likely include removing a portion of the existing timber crib and replacing it with an earth dike, which in part will be under a new roadway.

2.2.3 Main Street and Norwood Bridges Project - On May 10, 1994, the Water and Waste Department requested approval-in-principle for the redesignation of the Primary Line of Defence. The dike realignment is required as a result of the proposed reconstruction of the Main Street Bridge and Norwood Bridge. On June 23, 1994, the Dyking Commissioner granted approval-in-principle for this relocation. This project is still ongoing and upon completion, the Water and Waste Department will be proceeding with application for redesignation.

2.3 South Area

2.3.1 Plaza Drive and Adamar Road Dikes - Easements have been secured for the dike between Plaza Drive and Bishop Grandin, and for the dike from Adamar Road to Plaza Drive. The Water and Waste Department has surveyed and will be preparing drawings of a portion of Bishop Grandin Boulevard to link the Plaza Drive dike to the D'Arcy Drive dike. Upon completion of the drawings described in Section 4.0, this Department will proceed with application for redesignation as well as dedesignation of those portions of the dike becoming redundant along Pembina Highway, University Crescent, Agassiz Drive and Glengarry Drive.

2.3.2 St. Norbert Daycare Dike - The St. Norbert Daycare proposed the installation of playground equipment on a portion of the primary dike. The Water and Waste Department provided a drawing showing where the new dike is to be realigned to by-pass equipment. Upon completion of all drawings, this Department will proceed with application for redesignation.

2.3.3 St. Norbert School Dike - An easement agreement has been finalized with the Catholic Parish of St. Norbert which will provide for the extension of the Primary Line of Defence South of the St. Norbert Cemetery, between Rue St. Pierre and the Seine River School Division property. The Water and Waste Department and School Division have exchanged letters regarding acquisition of an easement through their property.

During the 1997 Spring Flood event, a permanent earth dike was constructed through the Seine River School Division property extending from the existing dike South of the St. Norbert Cemetery at the East to Rue Campeau to the West. The Water and Waste Department will be proceeding with application for designation of the dike once drawings described in Section 4.0 are complete for this area, and the easement is secured from the School Division.

2.3.4 St. Norbert Dike - During the 1997 Spring Flood event, a permanent earth dike was constructed from the South end of the Lord Avenue right-of-way to the North end of the Rue St. Pierre right-of-way. The St. Norbert dike as well as the St. Norbert Cemetery and Seine School Division dikes (Section 2.3.3), provides for a continuous length of dike which will protect in excess of 50 additional properties. The Water and Waste Department will be proceeding with application for designation of the dike once all drawings described in Section 4.0 are complete for this area and easements are secured.

3.0 1997 SPRING FLOOD PROTECTION OPERATIONS

3.1 Summary

The City actively planned, prepared for and undertook specific flood protection activities as necessary in response to high river levels and overland flooding this past spring. Most City Departments and over 3,000 staff were involved in the activities this year, however, the focus of this report is primarily the activities carried out by the Water and Waste Department and the Streets and Transportation Department.

These two departments undertook a variety of activities, some of which occur annually, such as operation of flood pumping stations, gate chambers, snow clearing of ditches, and also activities which only occur for infrequent flood events, such as raising the primary diking system and sandbagging for secondary dikes.

For the 1997 flood event, the City provided sandbags for 800 properties requiring protection with secondary dikes. The primary dike system was raised at 25 locations and secondary earth dikes were constructed at 55 locations. All the City's 34 flood pumping stations were operated and a total of 131 flap and positive gates were checked and/or operated on sewer systems. Over 300 pumps of various size and capacity were also used on a temporary basis. Part of these flood fighting efforts were in response to the potential Z-dike failure.

3.2 Chronology of Events

January 20 — Flood preparation meeting at Emergency Operations Centre (EOC) - early indications from the Province of a record forecast.

February 1 — Actual snowfall since October 1, 1996 is 54 inches and normal is 26 inches.

February 6 — Flood preparation meeting with the Province on communications of their forecasts.

February 26 — Council adopted the Report of the Executive Policy Committee dated February 19, 1997, titled "Preparations for the 1997 Flood and Any Emergency Situation", which authorized the Board of Commissioners to do all things necessary, including spending funds, to prepare for flooding, or for any emergency situation.

The Provincial Water Resources Branch formally released a qualitative long range forecast for the spring runoff event, indicating there was a 50% chance of flood water levels similar to 1996 (19.4 feet at James Avenue) and a 10% chance of levels 4.5 feet higher below the Floodway and 8.0 feet higher above the Floodway.

February 28 — The first of weekly/semi-weekly meetings between staff of the Water and Waste and Streets and Transportation Departments was held to discuss and plan for flood protection activities. Major topics were: forecasts, number and location of properties at risk, availability of empty sandbags, sandbagger machines, field surveys and inspection, sandbag delivery operations, communications, problem areas, primary dikes, flood pumping station/ gate chamber operations, etc.

March 4 — Preliminary estimates were completed for the number of sandbags required for the secondary dikes based on the forecast river elevations. For the median forecast, 107 properties needed 400,000 sandbags and for the upper decile forecast, 256 properties needed 2,600,000 sandbags.

March 10 — Committee on Protection, Parks and Culture receives as information the report titled "1997 Flood Outlook and High River Level Preparations".

March 11 — First letters given to residents for survey notice.

A flood preparations briefing was given to the Committee on Works and Operations. Committee adopted the administrative policies with respect to secondary dikes, included in the report titled "1997 Flood Preparations - Secondary Dikes".

March 12 — Surveys for secondary dikes started for location and height.

March 14 — The Board of Commissioners adopts the report titled "1997 Flood Preparations - Purchase of Empty Sandbags", authorizing the Streets and Transportation Department to purchase the required number of sandbags to meet the flood forecasts.

March 19 Sandbagger #1 begins production at 2546 McPhillips Street at 23,000 sandbags per day. Sandbags produced are stockpiled.

March 21 Manitoba Water Resources Branch issues their second long range flood forecast, indicating there is a 50% chance of flood water levels similar to 1979 and 1996 (19.4 feet at James Avenue) and a 10% chance of levels 3.0 to 4.5 feet higher below the Floodway and 4.5 feet higher above the Floodway. Sandbag requirements now 265,000 for the median forecast and 1.5 million for the upper decile forecast.

A flood preparations briefing was held for Councillors and the media in response to the release of the second flood forecast.

March 24 Placement of survey monument discs on homes at risk begins.

March 25 Sandbag delivery begins to properties.

March 26 Total sandbag production to date is 140,000.

March 27 Delivery of information packages begins, notifying affected property owners.

Updated Flood Activity Manual covering flood pumping stations, temporary mobile pumps and gate chambers is distributed to staff.

April 1 Sandbagger #2 begins production at 1220 Pacific Avenue at 23,000 sandbags per day. With the two sandbaggers, production rate is 46,000 sandbags per day. Total sandbag production to date is 225,000.

April 5 Total sandbag production to date is 534,000.

April 5-8 "Blizzard of the Century" occurs in entire Red River Basin. Sandbag production and delivery shutdown for 2.5 days.

April 9 Sandbag production resumes, but at higher rate of 92,000 sandbags per day.

April 10 The Provincial Water Resources Branch released the third flood forecast: all levels are higher. Sandbags required are 310,000 (median) and 2.5 million (upper decile).

A City media briefing session was held immediately after the Province released their forecast and held a media briefing session, at the offices of the Manitoba Water Resources Branch.

April 13 Total sandbag production to date is 950,000.

April 15 Committee on Works and Operations approved a report recommending that the administration be directed in assisting the 768 Association Inc. in raising a portion of

their dike in the R.M. of Ritchot, and that all costs for work outside Winnipeg be deemed to be a Provincial or Rural Municipality responsibility.

April 16 — A sandbag dike building demonstration and public meeting are held at the St. Norbert Community Club.

April 17 — A sandbag dike building demonstration and public meeting are held at the Vince Leah Recreation Centre (in West Kildonan).

April 18 — A sandbag dike building demonstration and public meeting are held at the Windsor Community Centre (in St. Vital).

The Provincial Water Resources Branch releases a new forecast that indicates the median forecast is higher and the upper decile is relatively the same, except for the central and north areas of the City along the Red River where water levels are expected to reach 24.5 feet at James Avenue.

Decision made to construct earth dikes in locations where excessive number of sandbags required and where there is sufficient space to use heavy earth moving equipment. Decision made to provide four feet of freeboard to dikes south of (above) the Floodway since access will be restricted due to flood waters.

April 20 — The Provincial Water Resources Branch issues a forecast that confirms the flood peak elevations are expected to be close to the upper decile forecasts.

South Transcona floods.

April 21 — A 14 year old accidentally dies after falling into a ditch and swept into a 24" culvert on Leila Avenue. His body was recovered May 2 at Armstrong Pumping Station.

The Red River Floodway is activated by the Province.

April 21 — The Flood Operations Planning Team is set up in the EOC Boardroom.

April 22 — Total sandbag production to date is 2,000,000.

At 1155 Pacific Avenue the 24-hour secondary Dike Operations Centre (DOC) for technology services, technical call centre, evacuation coordination team operations and dike surveillance is established.

April 23 — Mayor declares State of Local Emergency.

Sandbagger #3 starts up. Total sandbag production to date is 2,170,000.

April 24 — Assiniboine River surges without warning. Provincial Water Resources Branch

temporarily stopped diverting Assiniboine River flows at the Portage Diversion to repair ice damage.

Additional survey crews hired from consulting industry.

Evacuation teams start up at DOC and review the evacuation criteria.

April 25 — Total sandbag production to date is 2,500,000.

Training of the first eight (8) Dike Surveillance Crews.

April 26 — Sandbagger #4 starts up.

Substantial overland flooding in south Charleswood - McCreary and McGillivray.

Geotechnical Emergency Response Team (GERT) set up at DOC.

Fort Whyte Nature Centre lakes opened to accommodate additional South area surface runoff.

April 28 — An engineering consultant's dam break analysis indicates the worst case of the Z-Dike failure is 60,000 cubic feet per second (cfs), which would result in Red River flows in Winnipeg at 100,000 cfs, the same as the 1950 flood, but with the Floodway in operation.

DOC Evacuation Teams assess homes at risk for evacuation.

April 28/29 — Joint City/Provincial/Canadian Forces meeting to develop contingency plans in case of Z-Dike failure.

April 30 — On Victoria Crescent the dike breached and the area was evacuated.

After further analysis, an engineering consultant establishes that a Z-Dike failure would result in 44,000 cfs with 8 to 40 hour breach development.

May 1 — DOC in operation with staff on 24 hour dike patrol, evacuation teams, survey crews and staff in the 24 hour Operation Call Centre with Canadian Forces field liaison officer working with senior staff directing the first response field crews.

May 3 — Red River crests at 24.5 feet in the City at James Avenue and 771.3 feet above sea level (geodetic) upstream of the Floodway.

Total sandbag production to date is 4,100,000.

May 4 — Preparation team established to repatriate evacuated areas.

May 6	Unexpected 7 to 10 inch surge in Red River water levels in St. Norbert due to Floodway gate operation.
	Preparation of cost estimates for "enhanced diking and flood proofing" begins as requested by the Provincial and Federal Governments, pursuant to the Canada-Manitoba Agreement on Red River Valley Flood Disaster Assistance, dated May 1, 1997.
May 7	Clarence Street street and basement flooding involving approximately 40 houses.
	Sandbag production by sandbagger machines ends at 4,338,000. Hand filled sandbag production estimated at 3,782,000.
May 9	Dike removal begins at critical riverbank instability locations with assistance from the Canadian Forces .
May 12	DOC Operations scaled down to damage assessment.
May 14	Flood Operations Planning Team deactivated and EOC Boardroom vacated.
May 15	EOC responsibility for: 1) sandbag removal operation transferred to the Streets and Transportation Department, and ; 2) removal or reshaping of earth dikes transferred to the Water and Waste Department.
	Preparation of cost estimates for repairs to City facilities damaged by the flood begins.
May 16	The City submitted to the Province a list of capital improvement projects for "enhanced diking and flood proofing" needed to protect the City to the Flood Protection Level (water level at 25.8 feet at James Avenue).
June 2	The Province lowered the Floodway control gates, deactivating the Floodway.
June to	Assessment of repairs, presentation of repair costs to Province, restoration of presentdamages and contract administration for infrastructure damaged during flood activities.

3.3 Red River and Assiniboine River Monitoring and Forecasts

Long range outlooks for spring flooding were issued and distributed by the Manitoba Water Resources Branch on February 26th and on March 21st. Once rapid increases in river elevations had commenced on April 6th, monitoring of river conditions continued until levels dropped below 7.0 feet at James Avenue on June 17th. Ongoing communication with the Manitoba Water Resources Branch and Environment Canada enabled daily updates of short term forecasts and long range outlooks for expected weather and river conditions. Daily river forecasts were issued between April 10th and June

4th. A river elevation information mail box was set up by the Water and Waste Department and updated twice daily during extreme elevations, and once daily under less threatening conditions. The crest at James Avenue of 24.5 feet was recorded on May 3rd, and the Floodway was in operation from April 21st until June 2nd.

In addition to the ongoing dialogue with Manitoba Water Resources Branch and Environment Canada, an engineering consultant was commissioned to undertake surveys to collect water level data on a daily basis over various reaches along the Red and Assiniboine Rivers, and along some tributaries during high flow conditions. It was thought that in addition to providing warning of potential trouble zones within the river system, collecting this data under the extreme flow conditions being experienced could prove to be valuable in future flood control and planning exercises.

Monitoring of river ice conditions was undertaken in cooperation with the Winnipeg Amateur Radio Emergency Service and the Winnipeg Police Service. This program was established in order to provide warning of potential ice jam conditions, and to identify ice jams which could have resulted in short term sudden rises in water levels over various reaches of the river system.

3.4 Flood Protection for High River Levels

3.4.1 The Primary Line of Defence (Primary Dike)

With the Manitoba Water Resources Branch April 19th revised Flood Forecast it was apparent that the City of Winnipeg's Primary Line of Defence (primary dike system) would have some deficiencies for levels in the higher range of the forecast. Subsequent forecasts confirmed that the flood levels would be close to 24.5 feet at James. It was determined that the primary dike should be built to 26.5 feet at James, which was the forecasted river elevation plus two feet for freeboard.
The Water and Waste Department began a review to determine the primary dike deficiencies. Initially, deficiencies were identified by using existing drawings and plotting the projected river elevations. In some cases the primary dike drawings were not up to date and surveyors were sent out to determine ground profiles. Water and Waste Department staff were also sent out to inspect the total length of the City's primary dike system, to confirm information on drawings and to look for new deficiencies or "holes" in the primary dike. Staff inspected sections of the dike system, identifying low spots and culverts that go through the dike. There were 26 locations or culverts identified as breaches through the primary dike, most of which were plugged by the Local Water and Sewer Division of the Water and Waste Department.

There were 25 locations where the primary dike had to be raised; these ranged from small clay dikes several feet in length and height, to dikes built on streets that extended several blocks and were 5 to 10 feet in height. The earth dikes were "keyed" or excavated into the existing ground to prevent failure or leakage of the dike.

3.4.2 The Secondary Line of Defence

The secondary line of defence or secondary dikes are those dikes that are not designated as primary dikes in the Provincial Statutes. Typically, secondary dikes are permanent and constructed of earth fill or temporary and constructed of sandbags or earthfill or a combination. Secondary dikes are usually located on private property, which property is typically situated outside the protection of the primary dike system.

For flood planning, the Water & Waste Department generates lists of properties at risk for the forecast peak flood water levels. Although early forecasts by the Province in February and March typically include median and upper decile forecasts, the City adopted policy is to plan and prepare for the "worst case" or the upper decile forecast. Basically, this forecast water level has a 10% chance of being met or exceeded. The estimated sandbag requirements are based on constructing secondary dikes to a level two feet above the forecast water level.

An information package was provided by the Water and Waste Department to all property owners who were identified as requiring a secondary dike. This package included information on the dike height, alignment, dike design and building, dike policies, volunteers, etc. Three hands-on sandbag dike building demonstrations/public information meetings were held, one in St. Norbert, one in West Kildonan and one in central St. Vital.

Sandbag requirements for properties at risk were summarized in spreadsheets. These spreadsheets were updated daily at the start of flood preparations, and as frequently as hourly closer to the flood peak, as survey information was received from the field. The spreadsheets package was distributed daily to a key list of staff involved in sandbag production and delivery, including the Dike Operations Centre (DOC) and the Flood Call Centre (Flood Hotline). All calls relating to individual property elevations were transferred to DOC who were in direct contact with all survey crews.

Surveys were undertaken on all properties at risk plus many more. In mid-March, survey crews from the Water and Waste and the Streets and Transportation Departments placed permanent elevation markers on the buildings (houses) located at known properties at risk. Approximately 100 buildings were tagged before survey crews moved to higher priority surveys for flood preparations. These markers allowed the City staff to respond more quickly and accurately to the constantly changing river forecast elevations, when setting or re-setting dike elevations. Surveys were also undertaken to determine the status of properties where there was no information and to set line and grade for the secondary dikes.

All secondary dikes were inspected regularly during construction. Initially the dike inspection was undertaken by Water and Waste Department and Streets and Transportation Department staff. As the flood evolved, however, there was a greater need for more staff to be involved in the construction inspection and also all other aspects of the dikes such as leakage and stability. Commencing before the flood peak and until river levels began to subside, there were teams of two people patrolling, monitoring and inspecting the dikes all across the City on a 24 hour basis.

Approximately 800 properties in the City of Winnipeg were protected by secondary dikes. Of these, 745 were protected by sandbags and 55 were protected by earth dikes. Of the total properties protected, 52 were above (south) of the Floodway. Also, 50 properties were on the inside of Kingston Crescent that did not actually receive sandbags but were nonetheless protected by those properties that did. In total, it was estimated that 3,900,000 sandbags were required to protect the 745 properties. This estimate was based on a standard dike cross-section design.

Total sandbag production was 8,120,000 sandbags, of which 4,338,000 sandbags were produced by the City's sandbagger machines and contract forces, and 3,782,000 sandbags were hand filled by volunteers, the penitentiary and the Canadian Forces. Actual production exceeded the estimate due to the use of sandbags for various additional uses. These included:

1. Sealing manholes from overland flooding.
2. Diking around existing permanent or temporary mobile pump stations.
3. Anchoring other flood protection works such as plywood splash boards and plastic sheeting used for erosion protection.
4. Fortifying secondary dikes constructed to the standard design to prevent leaks and failures.
5. Shoring up and repairing earth and sandbag dike leak and failure locations.
6. Providing assistance to neighbouring municipalities, such as the R.M. of Ritchot.

3.4.3 Secondary Earth Dikes

In mid-April, a decision was made to protect some properties with earth secondary dikes rather than sandbags. This was based on the fact that with the April 10th forecast, some properties would require 40,000 sandbags or more. Not only would these locations be faced with a tremendous labour effort, but the City's supply of sandbags was going to be seriously compromised and it was determined by the Water and Waste Department that earth dikes would be a better defence and more cost-effective. The criteria for earth dikes were: 1) property owner permission, where required; 2) sufficient lot size to permit use of heavy earth moving equipment, and; 3) potential for the dike to remain after the flood. In total, 55 locations had secondary earth dikes, of which 45 were on private property.

3.4.4 Construction of Primary and Secondary Earth Dikes

The Water and Waste Department undertook the coordination of contractors, equipment, consulting services, construction control and the supply of suitable earth dike materials required for the deficiencies in the primary dikes and construction of secondary earth dikes.

Contractors affiliated with the Manitoba Heavy Construction Association were contacted to assess equipment requirements and construction methodologies on a dike per dike basis to ensure their suitability to perform the required works. To have the dikes in place within the required time frame, a 24 hour operation was provided at many of the sites by several of the contractors. Payment for equipment was made based on hourly rates, at the rates provided by the Streets and Transportation Department.

Cartage (trucking) of dike materials during the construction phase was arranged by the Streets and Transportation Department. The cartage was also a 24 hour operation and payment was at the hourly rates provided by the Streets and Transportation Department. The magnitude of the operation required that over three hundred units (tandems and trailers) be mobilized for several days prior to the arrival of the crest.

Consultants were engaged to provide services to assess impacts to riverbank and dike stability, to identify and address permanence considerations including permits and to provide construction control for the larger dikes, such as at Turnbull Drive, Wildewood Club and St. John's Ravenscourt .

The supply of materials for dike construction necessitated creating borrow areas at the Brady Road Landfill Site, St. Mary's Road/Courchaine Road at the Floodway berm, Turnbull Drive at the Floodway berm and King's Park on King's Drive. The Turnbull Drive and King's Park borrow areas provided on-site dike material required for a "cat and scraper" method of construction. The borrow areas at Brady Road and St. Mary's Road supplied materials that were transported by trucks to the various dike sites. An estimated 300,000 cubic metres of clay material was removed from the Brady Road site and another 300,000 cubic metres of clay material was removed from the other sites during the dike construction phase. The borrow area at Brady Road was located where the next below grade refuse cell was to be constructed. The borrow areas at Turnbull Drive and St. Mary's Road were restored by seeding and regrading to provide positive drainage.

In total, earth dikes were constructed at 80 locations throughout the City (25 primary dikes and 55 secondary dikes).

3.5 Primary and Secondary Dike Operations Centre (DOC)

Demands for technical responses from the general public through the EOC resulted in the need for a 24 hour technical call centre, evacuation teams, survey coordination and 24 hour dike monitoring. Accordingly, the DOC was organized by the Engineering Division of the Streets and Transportation Department at 1155 Pacific Avenue to coordinate and respond to technology demands for the secondary dike field operations.

The DOC Call Centre was a vital link between the EOC, the public, survey crews, dike patrols, the first response Streets Maintenance crews and the Canadian Forces field crews. The 15 staff worked in 12 hour shifts providing coordination of survey crews including crews from various departments and consulting firms. They provided problem resolution for difficulties encountered in dike building and as well provided flood data and record maintenance. They provided the fundamental link between the dike surveillance teams reporting dike breaches and repair crews.

The staff of Technology Services of the DOC first started their flood activities on March 12th by participating in the surveys required for secondary dikes. They also provided up-to-date surveys to correct data necessary for determination of dike locations and to assist in accurate forecasting as to where potential trouble zones would occur. Prior to the peak of the flood, the Technology Services supervised all the survey requirements and utilized survey crews from other City Departments and private consulting firms to achieve maximum coverage in a relatively short time. These crews worked

12 to 16 hours daily providing contractor coordination and survey support to the City and Canadian Forces operations.

The Evacuation/Repatriation Teams and Dike Surveillance Teams started organizing April 22nd with the first 14 staff forming 7 teams. Criteria was established for predicting when homes should be evacuated, predictions were made and notices were given. Approximately 120 surveillance staff were trained and equipped with vehicles, floatation jackets and portable cellular phones by May 1st. The staff worked in teams of two for safety considering the 24 hour surveillance and night conditions.

Security was an issue for both contractors and City staff where sight-seeing citizens got too close to the earth dike construction and where reports of vandalism to sandbag dikes were received. As a result, dike monitors, Streets Constables and Commissionaires coordinated with both the Police and the Canadian Forces to enhance security. The Survey, Evacuation and Dike Surveillance Teams also became public relations facilitators for both the public and press.

In summary the DOC at 1155 Pacific Avenue carried out the following areas of responsibility.

Technology Services
- Survey control for dike location, elevation and construction, ie house monuments.
- Coordination of survey crews/staff from various departments and consulting firms.
- Inspection of dikes.
- Identification and problem resolution of dike locations.
- Contractor coordination.
- Canadian Forces technology support.
- Damage inspection/estimating.
- Coordination of streets infrastructure repairs.
- Input of data for computerized mapping.
- Record keeping.

Technical Call Centre - 24 hour operation.
- Technical call response, ie house elevations, geographic information, evacuation call response.
- Call response for dike breaches, evacuation, repatriation.
- Response to By-law enforcement concerns.
- Documentation of flood data, dike breaches.
- Liaison for Canadian Forces and City Maintenance first response.

Operational Services
- Assist in coordination of sandbag delivery and Canadian Forces operations.
- Evacuation and repatriation prediction and notification.
- Primary and secondary dike surveillance, training and monitoring.
- Coordination of Commissionaires and Police assistance for security and evacuation.
- Public relations duties; liaison with residents on site.
- Respond to news media and other field requests.

dikes to the intended standards, as heavy equipment could not operate on top of the dikes in these areas. Furthermore, when the dikes were raised approximately two feet in response to updated flood forecasts, the tops were typically much more vertical than the City standard and in most cases the addition was not compacted properly.

Property owners were responsible for construction of sandbag dikes, utilizing volunteers, and using construction procedures and training provided by the City. Their ability to follow the training and materials provided and the fact that the vast majority of volunteers had no training, created a wide variety of performance during the flood. Again, they made decisions about how their dikes were to be constructed which ultimately affected the performance of the dikes (eg. over rock gardens, around fences, etc.). As well, Canadian Forces personnel were involved with raising sandbag ring dikes protected by the Floodway to accommodate rising flood level forecasts.

Locations with ring dikes were typically south of the Perimeter Highway and, efforts were concentrated particularly upstream of the Floodway. Ring dike operations were carried out at the following locations:

- Hallama Drive
- St. Mary's Road/Greenview Road
- Pembina Highway/Minerva Avenue
- Christie Road
- Forbes Road
- Fraser Road
- Jean Louis Road
- Cloutier Drive
- MacBell Road
- Turnbull Drive
- Kilkenny Place
- Holly Drive

Ring dike operations involved 58 City staff on an ongoing basis, supplemented by support from the Fire Department and the contribution of the Canadian Forces.

Activities included:

- Pump Operation/Maintenance Inside Ring Dikes

  This activity involved City staff mainly from Winnipeg Hydro, Parks and Recreation, and Streets and Transportation Departments. Individuals were chosen with a mechanical background and familiar with operating watercraft, and equipment operation, maintenance and repair. The Harbour Patrol provided two persons to support this activity. A total of 44 City staff were employed on this activity.

Canadian Forces assumed responsibility for this activity at various locations. However, due to changing priorities, the City either assumed the responsibility or shared the responsibility with the Canadian Forces, depending on their availability.

- Ring Dike Condition Monitoring

Dike condition monitoring was carried out by the engineer in charge of ring dikes, with support from the Dike Operations Centre's (DOC) dike monitoring team, the Geotechnical Emergency Response Team (GERT), and engineering staff of the Canadian Forces.

- Ring Dike Repair

Ring dike repairs, after flood waters had surrounded the dikes, were carried out initially by a ten-person crew from the Streets and Transportation Department Construction Branch. The Canadian Forces provided significant support for this activity on Hallama Drive and on St. Mary's Road, south of the Floodway.

- Raising the Level of Ring Dikes to Meet Flood Level Forecasts

The aforementioned Construction Branch crew were also tasked with raising sandbag dikes on St. Mary's Road. Again, the Canadian Forces provided significant support for this activity on Christie Road, Jean Louis Road, Fraser Road and Forbes Road, all west of St. Mary's Road.

- Owner Access

The Winnipeg Police Service, with assistance from the Canadian Forces, provided for controlled and restricted access to flooded areas within the City at control points on PTH #59 at Hallama Drive, on St. Mary's Road at the South Perimeter Highway and at the Floodway, and on Pembina Highway at the South Perimeter Highway. RCMP and the Canadian Forces provided for access control to points south on PTH #59 north of the Floodway and on Pembina Highway at Turnbull Drive. Property owners were admitted through a pass system so that Police knew who was in the evacuated area. When flood waters had receded to the point where road access to property entrances was possible, private security staff were hired to control access in and out of the sites at Hallama Drive and St. Mary's Road south of the Floodway.

Owner access to flooded properties was accomplished using City staff involved in pump operations. The Canadian Forces provided similar service on occasions that they assumed responsibility for pump operations for ring dike properties protected by the Floodway.

- Security Checks

Following an initial Police Department check of properties, security checks on flooded properties was accomplished using City staff involved in pump operations. The Canadian

Forces provided similar service on occasions that they assumed responsibility for pump operations.

- Safety/Control on the Water

  The engineer in charge of ring dikes and staff from the Harbour Patrol provided for safe operation and control of watercraft in ring dike areas located south of the Floodway.

- Media Access

  Media access in the ring dike areas was accomplished using City staff involved in pump operations, including Harbour Patrol staff. One bilingual staff person was available during the day shift (not by design).

Approximately 26 boats were utilized by City staff for ring dike operations, including inflatable boats, 14, 16, 19 and 21 foot aluminum boats, one pontoon boat, and one pump barge. Boats were provided chiefly through the Harbourmaster from various City Departments and from local commercial sources. The Fire Department provided one aluminum boat for a period of time. The City of Calgary provided a hovercraft for emergency use in the area of St. Mary's Road south of the Floodway.

3.8 Brunkild "Z-Dike" and St. Norbert Protection Dike

On April 24th, the City became aware that the provincial authorities were concerned that the length of the West Dike was insufficient to prevent expected flood waters from spilling into the La Salle River and flooding the City from the southwest, and they had in fact begun construction of a (originally) 15 mile (24 kilometre) extension on April 23rd. This was to be further extended some 10 miles (16 kilometres) as construction proceeded.

Due to rising floodwaters, the ambitious schedule was to complete the 15 mile, five to eight foot high dike in five days, by April 28th, the date that flood waters were expected to reach the dike. The Manitoba Department of Highways directed the project with assistance from a large private contractor and the Canadian Forces. This was done under less than ideal soil/weather conditions and materials, with no freeboard allowance.

An engineering consultant completed a computer simulated "dike-break analysis", ultimately indicating that a breach in the Z-Dike could result in a worst case 60,000 cubic feet per second (cfs) discharge, flooding Sanford, LaSalle, and the City of Winnipeg similar to the 1950 flood. The Manitoba Water Resources Branch (MWRB) further advised that portions of the existing West Dike also had to be raised. Considering the lack of freeboard and construction practices, steep side slopes, wind, wave, debris, erosion, and rain potential, serious concerns were raised. Due to concern over the integrity of the dike, the following events quickly took place:

- At a Manitoba Emergency Management Organization (MEMO) meeting, it was decided that the Canadian Forces, the Province, and the City would join forces in an intensive two day evaluation and mass evacuation planning session at Building 84, CFB Whytewold on April 29th. Several key staff representing all major Provincial and City Departments participated, including Fire, Police, Health, and Social Services. At stake was the potential evacuation of 125,000 City residents.

- Under direction of the MWRB, a "Z-Dike Engineering Task Team" was set up to determine critical hydraulic/hydrology parameters and level forecasts, provide technical advice and information to other agencies, and develop contingency floodway operations scenarios. The ten member team consisted of hydraulic engineering experts and hydrologists from the MWRB, Acres Consultants, the University of Manitoba, Manitoba Hydro, and the City. The first meeting was April 29th, and the team met almost daily for the following two weeks. As a result of dealing with other issues, this team was later renamed the "Flood Management Task Force".

- The City revised it's planning strategy in terms of the "Real Event", which was the forecasted flood event, and the "Potential Event", a breach of the Z-Dike, in order to allocate resources.

- The City established the South Perimeter Highway (PTH 100) as a primary dike, as a more secure and defensible structure to protect the City at large in the event of a breach.

- The City and the Province agreed to assess/coordinate a 24 hour evacuation notice for the R.M. of Macdonald and St. Norbert when flood waters attained the base of the dike.

- The City constructed the St. Norbert Protection Dike along the southern limits of St. Norbert north of the La Salle River. This dike ran from the raised primary dike on the east side of Pembina Highway over to the west side along Rue des Trappistes to the Brady Road landfill.

On April 28th, the initial 15 mile phase of the Z-Dike was completed on schedule. The 10 mile extension and improvements to protect the Z-Dike were initiated.

The Z-Dike Engineering Task Team initially determined that under the worst case scenario (60,000 cfs breach), flow estimates were 88,000 cfs in the Floodway channel (60,000 cfs is design capacity, but the channel has some "reserve capacity") and 92,000 to 100,000 cfs in the City (1950 was 104,000). These flows meant the potential evacuation of 125,000 City residents.

It was subsequently determined that it was theoretically possible to store floodwaters for five to eight days and thereby maintain control of the Floodway. Some 8 major openings in the Floodway banks were identified for closure. The water level above the Floodway was estimated to be 775.5 feet or five to six feet higher than the then forecast for the "Real Event". This plan made it possible to protect the City from a Z-Dike breach scenario. It would result in holding the peak water level at 24.5 feet at James Avenue, although levels would be relatively higher in south Ft. Garry/St. Vital/St. Norbert (761.5 vs. 760.0 feet).

With this information, it was determined at the CFB Whytewold sessions that evacuations would only be required south of PTH 100 (St. Norbert) and possibly in low unprotected areas within the City involving up to 10,000 residents in total. Operations plans were produced to effect this. As well, the City prepared for this "Potential Event" by carrying out specific actions such as closing openings in the South Perimeter Highway, raising the primary dike system in St. Norbert, and constructing the St. Norbert Protection Dike. As it turned out, the "Real Event" resulted in a peak water level of 761.1 feet.

Fortunately, a decision on implementing the plan to store floodwaters above the Floodway was ultimately not required due to a series of fortuitous events. A land ridge parallelling the Morris River formed a natural barrier impeding flood waters. Favourable (north) wind conditions, combined with the elevated rural mile-road network, slowed the northward pace of floodwaters. Very little rain fell and drying conditions were favourable. Flood levels at Brunkild did not follow those at Morris as expected, and were much lower. By May 5th, it was evident that the risk of any breach had fallen considerably, and only a strong south wind combined with significant rain could pose a threat, an unlikely, although possible event. The risk diminished daily, and the City's EOC decided to repatriate the St. Norbert evacuees starting May 12th, subject to removal of major dikes and stabilizing the sewer system.

Plans are under way to relocate sections of the Z-Dike to more suitable locations. Slope flattening, stabilization, erosion protection, restitution of borrow pits, and crossings are in various stages of design and construction.

3.9 Sandbag Dike Removal

In mid-May, all residents who received sandbags were advised by letter that sandbag removal should be initiated. Of these, half the properties were advised that they were identified by the geotechnical engineers where removal of sandbags should begin immediately due to the potential for riverbank instability and failure. The Streets Maintenance and Construction Division of the Streets and Transportation Department assisted property owners with the removal of sandbags by coordinating the Canadian Forces, contractors and volunteers. The City had the bags picked up from the pavement of the front street and disposed of in the landfill or on private property (not on the river) with the permission of owners. Citizens were also allowed to remove sandbags from the piles on the streets for general yard and garden use. Sandbag removal was essentially complete by June 25th.

3.10 Conversion of Primary and Secondary Earth Dikes

The dikes at 50 locations (10 primary dikes and 40 secondary dikes) were modified to become permanent structures. Some notable locations of converted primary dikes include behind the St. Boniface Hospital, the end of Whellams Lane, and Salme Drive. For those locations where the primary dike was not made permanent the dike was removed and the damage caused by building the dike has been repaired.

The majority of the secondary dikes were on private property and any conversion plan had to be agreed to by the property owner. The final height and the location of the dikes were largely dependant on bank stability, level of flood protection the owner desired, ability to maintain the dike (grass cutting), and aesthetics (ie. view of the river and impact on trees, fences, and decks, etc.). Some notable locations where temporary secondary dikes were made permanent are Turnbull Drive, Parkwood Place, Rue Des Trappistes and several ring dike locations south of the Floodway.

Restoration of converted secondary dikes was the responsibility of the property owner. Dikes that remained and would be designated as portions of the Primary Line Defence were restored and sodded.

3.11 Pumping Station and Gate Operations

In preparation of the anticipated high water event, wastewater collection crews undertook an extensive system wide check of flood pumping stations and gates to ensure that all facilities were operational and that their operating status was appropriate. Initial flood preparation activities also included the issuing of electrical inspection requests to Manitoba Hydro, Winnipeg Hydro, and the Water and Waste Electrical and Instrumentation Branch, in order to ensure a satisfactory degree of flood readiness existed within the sewer collection system. A request to Winnipeg Hydro to upgrade the feeder priority of each of the Flood Pumping Station services within its service area was also made.

Commencing April 7th, the Water and Waste Department Regional Operations Division and Local Water and Sewer Division undertook flood activities in accordance with the Flood Activity Manual. This manual includes most activities related to flood proofing the sewer systems on the major rivers, and is revised annually in accordance with changes in the collection system. Specific activities are related to rising river levels, and include activation and operation of the flood and underpass pumping stations, and checking or operating flap and positive control gates on the sewer systems. During the 1997 spring high river event, all of the City's 34 flood pumping stations were operated and a total of 131 flap and positive gates were checked and/or operated on the sewer systems.

Operational complications encountered included leakage through surge well stop logs and discharge blocks at some flood pumping stations. These problems, which had not been experienced by existing staff in the past, were a product of the exceptional high river levels being experienced at the time. High flow rates were also present throughout much of the sewer system as undocumented cross-connections, undetected leakage, and ungated outfalls all contributed additional water. A variety of measures were used to plug and control known sources of additional inflow.

3.12 Stormwater Retention Basin Monitoring

Stormwater Retention Basins (SRBs) were operated during the spring of 1997 to function as rainfall storage reservoirs beyond design capacity for runoff within the city during high river levels. Additional pumping was established within SRB and other land drainage systems to provide the

maximum runoff storage possible in the event of significant rainfall. An engineering consultant was hired to survey water levels of critical SRBs, particularly those with walkout basements. This information provided operational data and warning as to potential problem sites. Sandbagging of homes bordering on SRBs took place at three locations with no flood damage resulting.

Isolation of Whyte Ridge SRBs and installation of an earthen dike for Waverley Heights' SRBs took place to protect against Lot 16 Drain. Baldry Creek and Beaujelais Coulee were also isolated to prevent the Red River from backing up into the Fort Richmond SRBs. The Ravelston Deep Pond was pumped at Ravelston and again at Kildare and the Floodway to maintain a low level in both the Kildare trunk sewer and the Transcona land drainage system.

3.13 Temporary Pump Setups, Gate Closures and Plugging of Dike Breaches

All land drainage, combined sewer and wastewater overflow outfalls penetrating the primary dikes that had either flap gates or flap and positive gates were checked for proper operation and were operated in accordance with the Flood Manual. A number of outfalls without control gates were identified before river levels reached elevations that would cause a concern for the systems they serviced. Temporary control devices such as inflatable bags or sand bags were installed, normally on the river end of the outfalls. Submerged breaches were plugged from the dry side.

Temporary pumping was installed at locations identified in the flood manual and at several other locations to pump any flows in sewer outfalls into the receiving streams. Portable pumps were also supplied to many secondary dike locations where homeowners were unable to find a pump, for seepage control. In total, the City used over 300 pumps of various size and capacity on a temporary basis. There are a small number of outfalls (both City and private) that penetrated dikes that were not gated. These outfalls and any interconnections between the wastewater, combined and storm sewers were plugged to prevent overland and basement flooding. Breaches of the primary dike on Victoria Crescent caused by unknown and unauthorized septic field outlets caused some concerns. One breach was closed by filling a septic tank with concrete.

3.14 Isolation of Water and Sewer Service in St. Norbert

Contingency plans were developed to isolate watermains and sewer mains servicing St. Norbert should St. Norbert be flooded. Watermain valves would be closed to prevent contamination of the water supply north of the Perimeter Highway. Wastewater sewers would be plugged to prevent inundation of the wastewater sewer system. Breaches of the Perimeter Highway and the temporary St. Norbert Protection Dike (west) were identified at the outlet for the Baldry Lakes, Beaujelais Coulee and the Westendorf Coulee. Combinations of air bags, coffer dams and clay plugs were used to close these breaches. Very large electric submersible pumps and tractor driven agricultural pumps were installed and operated to reduce water levels in the Baldry lakes, Beaujelais Coulee and Westendorf Coulee. Installation of discharge piping for the Baldry Lakes system necessitated closure of the Perimeter Highway.

3.15 Sewer Modification in Homes, Apartment Blocks, Commercial Properties and Park's Buildings

Modifications to basement plumbing were required in a number of homes protected by sandbag and earth secondary dikes. If the secondary dikes would have failed, basements would have been flooded and river water would be able to enter the wastewater sewer system through floor drains, toilets, sinks and other plumbing fixtures. This would overload the wastewater system and would result in basement flooding in areas that were protected by the primary dikes. Modifications were made in a manner so the weeping tiles could continue to function. Up to 12 plumbers and 6 helpers made these modifications to approximately 500 homes. In addition there were a number of homes that had to have modifications made to main floor plumbing where the main floor was at an elevation lower than the predicted peak water level. In a few instances where secondary dikes did fail, divers were used to plug floor drains completely so weeping tile flows would not overwhelm the wastewater sewers.

Approximately 65 apartment blocks and commercial properties protected by secondary dikes were inspected and plumbing modifications, including temporary pumping, were done at approximately 50% of those properties. Any modifications were done at the owners cost, normally by plumbers engaged by the owners.

Contingency plans were also developed to isolate the sewer system in the vicinity of areas protected by secondary dikes. Should a dike breach occur, and the plumbing modification not restrict the entry of river water, then the sewer could be isolated from the remainder of the sewer collection system.

Parks facilities subject to flooding were inspected and Parks staff flood proofed any plumbing fixtures or breaches of primary or secondary dikes.

3.16 Sewer Backup Protection for Health Care Facilities

The Water and Waste Department provided technical assistance through an engineering consultant to the Health Sciences Centre, the St. Boniface Hospital and the Misericordia Hospital. The Streets and Transportation Department provided the same service through the same consultant to personal care homes. This was done to identify locations where these facilities were vulnerable to basement flooding in the event of sewer system backup caused by high river levels.

The City provided temporary pumps and assisted in identifying locations requiring installation of backwater valves. Coordination of contractor installation of backwater valves and other devices, setup of pumps, and blocking of sewer manholes was undertaken through the City's consultant.

3.17 Sealing of Wastewater Manholes

The sealing program was required to ensure wastewater sewers were not overwhelmed due to street inundation during a rainstorm event. Several separate sewer districts were more susceptible to flooding during the peak river level than the combined sewer districts, due to the lack of permanent

pump facilities and reduced hydraulic capacity. Indeed, several areas of the City in separate sewer districts had ground elevations below the forecast peak river level.

Sealing was performed by regrouting below the metal frame of the manhole, installing manhole lid plugs, double wrapping the cover with polyethylene sheet, replacing the manhole cover and placing sufficient sandbags to cover the frame and lid. At locations where inundation was almost certain, a rubber caulking or "Ram Neck" was applied to ensure sufficient sealing.

Between 200 and 300 wastewater sewer manholes located in low-lying areas were sealed during the flood. This included critical structures such as low lying gate chamber access structures. All manholes throughout the City on both the wet side and dry side of the primary dike below James 25.0 feet were sealed. Additional manholes lying below James 25.5 feet and James 26.0 feet were sealed in the areas south of the Perimeter Highway and in the Baldry Creek catchment, respectively. These areas required sealing due to the Z-Dike failure scenario and due to the blocking of the Baldry Creek at the Red River. Manholes below elevation 232.2 feet geodetic in the Kildare Trunk (Transcona) area were sealed to provide protection to a 25 year spring storm. The Kildare Trunk sewer discharges to the Floodway and peak water levels in the Floodway were above the ground elevation in the western portions of the drainage district.

3.18 Treatment Plant Operations

Flood water from high river levels, and to a lesser degree overland flooding, entered the wastewater and combined sewer systems and was conveyed to the wastewater treatment plants. These additional flows required additional pumping at the plants and hence additional electrical costs were incurred.

During peak river levels, reduced hydraulic capacity at the North End and South End Water Pollution Control Centres necessitated the intentional discharge of wastewater to the Red River before reaching the plants (at river crossings), and at the plants (by bypassing of treatment processes in order to minimize head loss through the facilities). Intentional discharges took place at D'Arcy, Cockburn, Baltimore, and Mager Pumping Stations. Diversion of Windsor Park Pumping Station wastewater flows to the North End Plant also took place. These activities were successful in avoiding an overloading of the interceptor system and wide spread basement flooding.

At the SEWPCC, Primary and Secondary treatment processes were bypassed and temporary modifications to the outlet chamber were also required. Diluted wastewater was pumped to the river. At the NEWPCC, the wastewater received primary, but not secondary treatment. This situation occurred roughly over a two and one half week period from April 24th, and was common to virtually all wastewater treatment plants along the Red River in the U.S. and Canada during peak river levels. The weakness of the wastewater, the low water temperature, and the record high flows ensured that no environmental or public health consequence would result. Manitoba Environment was formally notified of these actions.

3.19 Basement Flooding in Fort Garry

On May 7th, a rainstorm occurred and several areas in Fort Garry experienced basement flooding. The land drainage system on Clarence Avenue (served by Riviera Outfall) surcharged to street level and street flooding occurred. This resulted in some overland flooding as well as flooding of the wastewater sewers within the area. As soon as it was determined that the water elevation within the land drainage system was above the river elevation, the outfall at Riviera was opened and the water level subsided. At the same time, temporary pumps were installed at Marshall Bay and Clarence Avenue to pump the wastewater sewer into the land drainage sewer in order to alleviate basement flooding.

Coincident with the foregoing, a 200 millimetre wastewater sewer on Pembina Highway at Finch Bay collapsed and as a direct result, water backed into the basements of businesses along Pembina Highway.

There was also an incident of flooding which occurred at Prestwood Place and Kilkenny Street as a result of the land drainage system surcharging.

3.20 Flooded Locations

Out of the total 800 properties protected for this flood event, 58 locations are known to have flooded. Of these, five were apartment blocks and the remainder were single family residences. At the apartment blocks and at approximately half the houses, flooding occurred below the main floor in the basement. In many instances flooding was a result of the seepage rate through the dike being greater than the rate of the portable pumps on site.

For the locations where it flooded above the main floor, the dike failed for one reason or another. A few sandbag dikes were not constructed to the target elevation, in some cases because the property owners did not believe the water would reach the forecast levels. At other locations the new earth dikes were eroded by the strong and fast currents. And at a couple of locations, the dike straddled the septic field allowing the flood water an easy route to the inside.

3.21 Bridge Operations

Bridge operations in response to the flood event commenced on April 21st. Existing Bridge Division personnel of the Streets and Transportation Department and engineering consultants carried out the response bridge impacts.

Responsibilities included:

- bridge performance monitoring
- maintenance of primary dike around bridges
- safe usage of bridges

- bridge modifications/repairs
- scour inspections

3.21.1 Bridge Performance Monitoring

Additional bridge inspections commenced on April 21st to monitor the impact of the flood event. City Bridge Inspectors monitored peak flows in the following order:

- Sturgeon Creek structures
- Assiniboine River structures and Omand's Creek structures
- Red River structures and Bunn's Creek structures

At critical structures, engineering consultants were engaged to provide monitoring services at the following locations:

- Provencher Bridge - condition monitoring
- Norwood Bridge - monitoring abutment pumps
- Henderson Highway Culvert (Bunn's Creek) - slope stability monitoring
- Kildonan Bridge - slope stability monitoring

3.21.2 Maintenance of Dikes around Bridges

Engineering consultants were engaged at Norwood Bridge primary dike to

- provide a stop-log dam at the riverwalk staircase, and
- place sheet-piling between the existing Norwood bridge and the new northbound structure, and
- place additional earth dike material at the northeast corner of the new northbound Norwood bridge.

City staff at the Elm Park Bridge removed existing pedestrian railing on the south approach to facilitate raising and extension of the Kingston Crescent secondary dike across the bridge approaches.

3.21.3 Safe Usage of Bridges

During the flood, the Elm Park Bridge was closed to all traffic as stabilization measures commenced the previous year had not been completed.

The Provencher Bridge was closed to traffic on May 5th, due to structural concerns with the bascule span and with the two bascule piers. The bridge was reopened to traffic after extensive repairs on July 14th.

3.21.4 Bridge Modifications/Repairs

Provencher Bridge was closed to traffic from May 5th to July 14th for extensive repairs to the bascule piers and to the twin-leaf bascule span. Repairs cost approximately $975,000.

Structures along Sturgeon Creek suffered damage to roadways, sidewalks, chain-link fencing and slope paving. Repairs were completed in October at an estimated cost of $125,000.

Voids under the Maryland Bridge were repaired at an estimated cost of $15,000.

A pavement washout under Henderson Highway at the Bunn's Creek culvert was repaired; however, undersealing works are yet to be completed. The estimated cost of repairs is $15,000.

Miscellaneous modifications/repairs were undertaken at various sites by the City at an estimated cost of $10,000.

3.21.5 Scour Inspections

Following an inspection of the Provencher Bridge, scour inspections around river piers were carried out at 12 additional bridges on the Red and Assiniboine Rivers. It was confirmed that no scour repairs were required at these structures. The study was done at an estimated cost of $55,000.

3.22 Overland Flooding

3.22.1 South Transcona/Charleswood

Several activities were undertaken to reduce the chance of overland flooding in South Transcona and Charleswood. Snow and debris were removed from the local ditches and frozen culverts were thawed. In fact, snow had to be removed a second time after the blizzard on April 5th to 8th, but there were only sufficient resources available to clean the major ditches and drains. Sandbags were made available at Streets Department maintenance yards for pickup by the general public, and also at the Esso gas station in South Transcona.

Other flood protection measures undertaken in South Transcona included the setup of a temporary mobile pump to transfer water from the Dugald Ditch to the wastewater interceptor in Dugald Road. As well, a temporary pipe interconnection between the Dugald Ditch and the land drainage sewer system in Regent Avenue was opened to divert part of the flow from the Dugald Ditch. Together, these temporary short term measures cannot handle the spring runoff, as was proven again this year with the flooding that resulted.

3.22.2 Sturgeon Creek

Water spilled over the Ness Avenue crossing of Sturgeon Creek and it was closed to traffic for approximately one week in late April as a result of high flows in the creek. The Saskatchewan

Avenue road crossing was also closed for the same time period. Water did not spill over the road but was lapping at the edge and did cause some erosion of the road and also at the railway crossing.

3.22.3 Bunn's Creek

Bunn's Creek had a flow of approximately 200 cubic feet per second during the peak level of the Red River. It was determined that it was not feasible to block Bunn's Creek at the outlet to the Red River and set up temporary pumps. To prevent overland flooding due to Bunn's Creek flows and the back up of the Red River, earth and sandbag secondary dikes were constructed and manholes on the land drainage sewer system were sealed.

3.22.4 Truro Creek

Truro Creek was not a problem this year as the City and the Winnipeg Airports Authority Inc. met prior to snow melt runoff and devised a plan to prevent overland flooding. The preventative actions were carried out by the airport staff on airport property.

3.22.5 Other Waterways

In several locations throughout the City, watercourses had well above normal water levels, as a result of snow melt runoff and reduced outlet capacity but overland flooding was prevented. For example, Baldry Creek and Beaujelais Coulee were plugged at the outlet to prevent back up of the Red River and temporary pumps were setup to discharge the accumulated runoff. Similarly, the Westendorf Coulee was plugged at the outlet to the LaSalle River and a temporary pump was setup. As well, the Lot 16 Drain gate at the outlet was closed to prevent the back up of the Red River and a temporary pump was setup.

3.23 GWWD Railway/Water Supply

Regional water supply facilities experienced the following problems during the flood. The GWWD Railway which parallels the Shoal Lake Aqueduct, experienced washouts at 20 locations where local drainage ditches were unable to cope with the flood level run off water. Large quantities of ballast and a number of new culverts were installed at the wash out locations. The railway was out-of-service for a number of weeks which restricted access to the City's Water Intake at Shoal Lake. Fluoridation of the water supply was interrupted at the Intake due to a chemical shortage which lasted from May Th to May 21st.

Deacon Booster Pumping Station was at risk of flooding. Ditch maintenance and a clay dike successfully prevent any flooding at this location. A reservoir drainage pump building at Deacon Cell 1 experienced minor flooding. This location was protected by a sandbag dike. In addition, a valve pit was diked at Tache Booster Pumping Station as a precaution against flooding.

Elevations were checked for McPhillips, Hurst, and MacLean Water Pumping Stations and Reservoirs. The elevations at these facilities indicated that protection against flooding was not required.

3.24 Evacuation and Repatriation

Under the authority of the Emergency Measures Act, the City evacuated specific properties for the safety of the public. The evacuations were undertaken on an area by area basis depending on risk and consequences of dike failure. Specific criteria was established and areas were reviewed for evacuation as specific survey data was available and as the river level rose. For example, the houses south of the Floodway and others with ring dikes were evacuated when vehicle access was no longer possible due to flood waters. Other areas protected by sandbag dikes were evacuated when the water level was one foot above the lowest sandbag dike level and/or when the water level was one foot below the house main floor.

Homeowners were given evacuation notices as much in advance as possible and such notices included a evacuation checklist of what to do in advance, what to do when evacuating and what to take with you. Where the evacuated houses were connected to the sewer system the City arranged to have plumbers plug all fixtures below the peak water level.

In total, over 9,000 people were evacuated form their homes. Most were from the St.Norbert area as a precaution against the potential Z-Dike failure. Other areas were south of the Floodway, Kingston Crescent and Scotia Street, to name a few. All the residents between the primary and secondary dikes throughout the City were at one point put on "evacuation alert", when the City first learned of the potential Z-Dike failure scenario. This was later rescinded when the Z-Dike failure scenario flow potential was reduced.

Repatriation of the evacuated residents was even more of an effort than evacuation. Although the criteria was generally the reverse of the evacuation criteria, there were many other issues to deal with. For example, the sewer system in part of St. Norbert was generally flowing full without any residents as a result of a dike breach. This problem had to be rectified prior to letting anyone return home in order to prevent widespread basement flooding in St. Norbert. In all areas restoring gas service took longer than to shut it down because service personnel had to relight all appliances. Road access also had to be restored in many areas in St. Norbert, South of the Floodway and St. Vital East of the Perimeter. By mid-May, 97% of the evacuated residents had returned home.

3.25 Capital Improvement Projects

The City was requested by the Provincial and Federal Governments in early May, 1997, to prepare a list of projects needed to protect the City to the Flood Protection Level (water level at 25.8 feet at James Avenue). The City's submission was made on May 16, 1997

The list of capital improvement projects, known as the Capital Improvement Plan - Enhanced Diking and Flood Proofing, was developed pursuant to Item 5 of the Canada-Manitoba Agreement on Red River Valley Flood Disaster Assistance (1997), dated May 1, 1997. This agreement is a complement to the existing Province of Manitoba Disaster Financial Assistance Policy and to Canada's Disaster Financial Assistance Arrangements. The Governments of Canada and Manitoba entered into this agreement to commit to flood proofing measures.

Although the Red River levels in 1997 did not exceed the Primary Dike elevations, the City expended significant efforts and funds for diking and protection of its land drainage and wastewater sewer systems. Problems with the sewer systems operation which could result in widespread basement flooding could be caused from: 1) back-up of river water directly into the system underground piping; 2) inundation as a result of dike failure, and; 3) flooding from extreme rainfall events when the system hydraulic capacity is reduced due to elevated river levels.

The projects listed in the Capital Improvement Plan are designed to protect the City against damages from flooding of the wastewater collection and land drainage sewer systems. The projects include gates on sewer outfalls, upgrading of flood pumping stations, permanent secondary dikes, and permanent land drainage pumping stations, to name a few.

4.0 PRIMARY LINE OF DEFENCE (PLD) MAPPING

The Water and Waste Department is continuing a project initiated in 1986 to produce plan/profile drawings of the City's 115 kilometres of primary dikes. These drawings will update the plan/profiles prepared by the Provincial Water Control and Conservation Branch in 1967 in a modern, revisable format. The drawings will also identify deficiencies in the dyking system, location of manholes, pipes, catch basins, outfalls and control chambers which breach the dike, and areas where the dike must be realigned to keep pace with new development. Approximately 120 plan/profile drawings at a scale of 1:2000 will be produced.

Initially, aerial photographic mylars were produced and were to serve as base plans for the project. Underground services, street names, dike alignment, chainages, dike elevations, etc., were to be plotted manually on these aerial mylars. The PLD maps for North East District including cross-section drawings were completed manually. Upon completion of these maps, it was decided that this project shift from conventional drafting into computer aided drafting. Some advantages for the change into AutoCAD are:

1) the base information will be supplied by the City's Land Surveys and Real Estate Department (LS&RE). This digital data was produced by LS&RE for the City's Land Base Information System and is therefore accurate and available at no cost. The provision of this information will expedite drawing production;

2) AutoCAD provides consistency and clarity to the drawings;

3) future revisions to these drawings can be easily updated using AutoCAD;

4) AutoCAD provides the flexibility of plotting drawings accurately at any scale, for example the Operations Department may prefer smaller prints for field use.

The project is divided into 7 drawing series corresponding to the different sides of the Rivers. The entire project is now 85% complete. The Series are described as follows:

- Series 100 contains 16 drawings covering the West side of the Red River from the Forks north to the City limits, and is 100% complete.
- Series 200 contains 8 drawings covering the North side of the Assiniboine River from St. James Street East to the Forks, and is 100% complete.
- Series 300 contains 8 drawings covering the South side of the Assiniboine River from Kenaston Boulevard East to the Forks, and is 75% complete.
- Series 400 contains 28 drawings covering the West side of the Red River from St. Norbert North to the Forks, and is 90% complete.
- Series 500 contains 26 drawings covering the East side of the Red River from the Floodway North to the junction of the Seine River, and is 80% complete.
- Series 600 contains 16 drawings covering the West side of the Seine River from the Floodway North to the junction of the Red River, and is 90% complete.
- Series 700 contains 17 drawings covering the East side of the Seine and Red rivers from the Floodway North to the City limits, and is 75% complete.

5.0 RESPONSES TO DYKING COMMISSIONER'S QUESTIONNAIRE

The following pages include the responses from the Water & Waste and the Streets and Transportation Department listed below:

1) Local Water & Sewer Division - Water & Waste Department.
   a) East Area - reply attached.
   b) North Area - No changes to report.
   c) South Area - reply attached.

2) Engineering Division - Water & Waste Department.
   a) Design & Contracts Branch - No changes to report.

3) Bridge Engineering Division - Streets & Transportation Department.
   a) Bridge Engineering Division - reply attached.

RECEIVED 11 FEB 1998

THE CITY OF WINNIPEG

WATER AND WASTE DEPARTMENT

INTER-OFFICE MEMORANDUM

FILE No. 14-02-00-00 (012)

TO: Dan Wiwchar, P. Eng.,
Local Services Engineer
Water and Waste Dept.
105 - 1155 Pacific Avenue

FROM: Ed Hupalo
Supervisor of Local Water & Sewer
Water and Waste Dept.
552 Plinguet Street

DATE: February 9, 1998

RE: DYKING COMMISSIONER'S 1997 ANNUAL REPORT

1. The following are difficulties and problems with respect to high river levels.
   - Kenwood Outfall - requires flap and positive gate
   - Falconer Outfall - requires flap and positive gate
   - Blackmore Outfall - requires flap and positive gate
   - Minnetonka Outfall - requires control device in chamber
   - Rivergate Outfall - requires flap and positive gate.
   - Chelsea Outfall - requires flap and positive gate
   - Rowandale and Kildonan - requires positive gate
   - Oakcrest Outfall - require flap and positive gate
   - Lotus Lane Outfall - repairs to outfall and installation of positive gate scheduled for February 1998
   - Kingston Row Outfall - Seepage at Manhole. Sealing Manhole scheduled for February 1998
   - Riverpoint Outfall - Seepage at Manhole. Sealing Manhole scheduled for February 1998.

   Also - Vermette Outfall has a control structure which ties into Rivergate which has no controls
2. The following repairs have been carried out.
   - Victoria Cres Outfall - Gate has been repaired
   - Hastings West Dunkirk - Storm infiltrating sanitary. Repaired November 1997
   - Parkville Street and Parkville Bay - Gate repaired June 1997
3. Falconer Outfall is to be upgraded. See: K.G.S. Report
   Minnetonka Outfall - Outfall to be repaired. See: K.G.S. Report
4. Cannot think of any upgrades besides Shirley's Ditch.
   Don't know if Transcona qualifies as flood protection?

E. Hupalo

Ed Hupalo

EH/lw

C:\WP\EH\DYKCOM97

TOTAL P.02

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT
INTER-OFFICE MEMORANDUM

TO:	Mr. Doug McNeil Wastewater Planning Engineer Engineering Division	**OUR FILE NO.:**	**033-14-02-00-00**
		YOUR FILE NO.:	020-14-02-00-00
FROM:	**Mr. Kim Ridd**	**DATE:**	February 10, 1998

RE: DYKING COMMISSIONER'S 1997 ANNUAL REPORT.

FOR THE REPORTING YEAR (1997):

Replying

1. Yes there were some minor problems encountered with respect to broken and or leaking gates, as well as problems dealing with extremely high river levels.

2. Yes repairs were carried out to broken or leaking gates at the following locations;

    a) North Drive and Dunham

    b) South Drive and Crane

    c) Pembina Highway and Crane

    d) Pembina & Grandmont

3. Yes there were modifications and upgrades made to the outfall manhole at;

    a) Riverside and Calrossie

4. No. There were no other modifications carried out to my knowledge.

If you should have any questions with regarding to this memo, please do not hesitate to call me at 986-3675 or fax me at 488-4159.

Yours Truly,

Kim Ridd

Mr. Kim Ridd
Supervisor of Water & sewer - South Area

KR/wp

O:\WATER\GENERAL\DYKING-R.97

THE CITY OF WINNIPEG
WORKS AND OPERATIONS DIVISION
STREETS AND TRANSPORTATION DEPARTMENT

INTER-OFFICE MEMORANDUM

& WASTE

TO: Mr. D.D. McNeil, P.Eng.
Wastewater Planning Branch
Engineering Division

'98 FEB 18 A10:18

FROM: Mr. L.S.W. Larkin, P.Eng.
Manager of Bridge Engineering

REF: C:\DYK97.wpd

DATE: 1998 02 11

RE: DYKING COMMISSIONER'S 1997 ANNUAL REPORT

The following is in response to the questionnaire for the Annual Report on the Primary Dyking System for those portions under our jurisdiction:

1. **For the Reporting Year**

a) Difficulties and problems encountered.
None.

b) Maintenance and repairs carried out.
None

c) New Sewer Outfall Gate Structures constructed.
None

d) Improvements and modifications carried out.
None

2. **Proposed Plans for Future**

Construction continues on the Main Street and Norwood Bridges Project. The work includes modifications to the primary dyking system at several locations, river bank stability improvements, and river bank erosion control measures. The proposed modifications have been reviewed and accepted by the Dyking Commission. The integrity of the primary line of defence will be maintained during the construction period. Construction is currently on schedule for completion by July, 1999.

As part of the York Avenue Underpass/Forks Access Project the following work is proposed for 1998: a portion of the existing timber bin- type primary dyke located between Steven Juba Park and the Provencher Bridge will be replaced with a earthen dyke; a land drainage outfall gate structure will be constructed on the west bank of the Red River north of the Provencher Bridge; and related rip rap and bank stabilization works.

Continue monitoring existing slope indicators.

River Bank Stability

a) Evaluation of river bank stability in critical areas.
Monitoring of slope indicators were undertaken at the following riverbank locations: Main Street Bridge, Norwood Bridge, Henderson Highway at Bunn's Creek, Pembina Highway north of Turnbull Drive, Pembina Highway at La Salle River and Kildonan Bridge.

b) Monitoring erosion of river banks in critical areas.
River bank erosion is monitored at all river crossings on an annual basis.
Erosion noted was unremarkable in 1997.

c) Any remedial works undertaken or completed in the reporting year.
None

3. **Availability and Location of Proposed Borrow Pits**

No change.

BE/be

HE UNIVERSITY OF MANITOBA

PHYSICAL PLANT

89 Freedman Crescent
Winnipeg, Manitoba
Canada, R3T 2N2

FAX: (204) 474-7547

January 12, 1998

File: 11.1.5

Mr. Frank P. Barlishen, P.Eng.
Dyking Commissioner
Water Resources Branch
1577 Dublin Avenue
Winnipeg, Manitoba
R3E 3J5

Dear Mr. Barlishen:

Subject: **Dyking Commissioner's 1997 Annual Report**

The following is in response to the questionnaire for the Annual Report on the Primary Dyking Systems within the City of Winnipeg:

1. 1997 Calendar Year

   a) Difficulties and problems encountered: None.

   b) Maintenance and repairs carried out: Valves, bearings and electric motors were checked at the UofM storm sewer pumping station for satisfactory operation, as well as #2 outfall and #8 outfall gate valves were replaced.

   c) New Sewer Outfall Gate Structures constructed: None.

   d) Improvements and modifications carried out: None.

2. Proposed Plans for the Future: None.

   a) Evaluation of river bank stability in critical areas:

      No evaluation studies are presently underway in connection with the "Primary Dyking" system. However,

fifteen river bank location check points along the south, east and north riverbanks had been established in 1988, which are regularly monitored by University of Manitoba Physical Plant staff. During 1997, as a result of higher than normal spring river levels, river bank slippage at a small area near outfall #1 was measured at 50 centimeters. All other river bank check points movements were between 0 and 14 centimeters.

The bank adjacent to the Wallace Building (Geological Sciences) site was monitored throughout 1996 by University of Manitoba Physical Plant staff, which will be continued on a regular basis. During 1997 bank slippage of approximately 5 cm was detected.

b) Monitoring of erosion of riverbanks in critical areas:

Monitoring of riverbanks is conducted regularly all year round. This is particularly carried out near storm sewer outfalls. No excessive erosion was detected during 1997.

c) Remedial work was not required during 1997.

3) Availability and Location of Proposed Borrow Pits:

No changes are suggested in the availability or location of proposed borrow pit for 1998.

Yours sincerely,

H. Frank
Director of Physical Plant

hf/nl

cc: Mr. T. G. Falconer, Vice President (Administration)
Mrs. D. McCallum, Associate Vice President (Ancillary & Physical Resources)